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EVALUATION OF SURFACE WATER QUALITY FOR ROCKY FLATS PLANT TERMINAL PONDS A-4, B-5, AND C-2

PREPARED FOR
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1 0 Introduction

This report describes results of pond water treatment operations and pond management activities at the Rocky Flats Plant (RFP) A historical perspective for the use of the treatment systems and a summary of analytical data available for 1990 and 1991 for both untreated and treated pond water are provided Recommendations are made regarding the continued use of the water treatment system and commitments to an extensive sampling and analysis program considering both the ambient water quality and overall cost of the operation

2 0 Background to Pond Water Management

2 1 History and Regulatory Climate

There are three main goals in effective pond management at the RFP (1) to ensure adequate control of surface water runoff through detention of a major storm event, (2) to provide spill control and containment and (3) to ensure high-quality water discharges through routine monitoring and treatment, if necessary, for potential contaminants prior to release These goals (which carry virtually equal importance) have guided pond operations for many years, but were expanded in scope as a result of the events following the chromic acid incident (February 1989) and EPA/FBI investigations (June 1989) As a result of allegations of water contamination with exotic and hazardous chemicals, increased monitoring and assessment of RFP waters were subsequently dictated via the Agreement in Principle (AIP) The AIP gave a stronger role in ongoing water management decisions to the Colorado Department of Health (CDH) There was also increased involvement from downstream water users, further resulting in expanded activities for reporting and control of the pond operations program

In January 1990, the Colorado Water Quality Control Commission (CWQCC) adopted stringent water quality stream standards for Segments 2, 3, 4, and 5 of Big Dry Creek Basin, which comprise Walnut Creek, Woman Creek, Standley Lake, and Great Western

Reservoir Although the new standards (first proposed in June 1989 and finalized March 30, 1990) are not reflected in the current RFP National Pollutant Discharge Elimination System (NPDES) permit, the Department of Energy (DOE) and CDH have been using the standards to evaluate and control the quality of water discharged from the terminal RFP detention ponds DOE has agreed to attempt to meet the CWQCC stream standards without stipulating any authority on the part of CDH or EPA to regulate radionuclide discharges from the facility

Shortly after temporary water quality stream standards were proposed for the upper reaches of Walnut Creek and Woman Creek that originate in RFP controlled areas, treatment of water prior to release began to ensure that the stream standards are met The quality of pre-release and discharged water has been closely monitored by RFP and its subcontractors as well as by the regulatory agencies and local communities

According to provisions of the AIP, samples of water must be provided to CDH to allow assessment of water quality before discharge The mechanism for discharge has been that CDH directs concurrence to the Department of Energy/Rocky Flats Office (DOE/RFO), which subsequently directs EG&G to initiate downstream release in accordance with stipulated conditions CDH concurrence on discharge is provided in written form after sufficient water quality data are available (usually the result of split sampling by CDH and RFP) to indicate that the water is of high quality and meets all requirements for release to Walnut Creek or Woman Creek CDH concurrence had typically required that continuous treatment be conducted during discharge

2 2 Water Treatment Methodology

In August 1989, RFP began treating water discharges from Pond A-4 and Pond B-5 using granular activated carbon (GAC) adsorption to remove trace levels of atrazine, an EPA-approved herbicide GAC systems have been used to condition the water discharged from the three terminal ponds (A-4, B-5, and C-2) throughout 1990 and into 1991

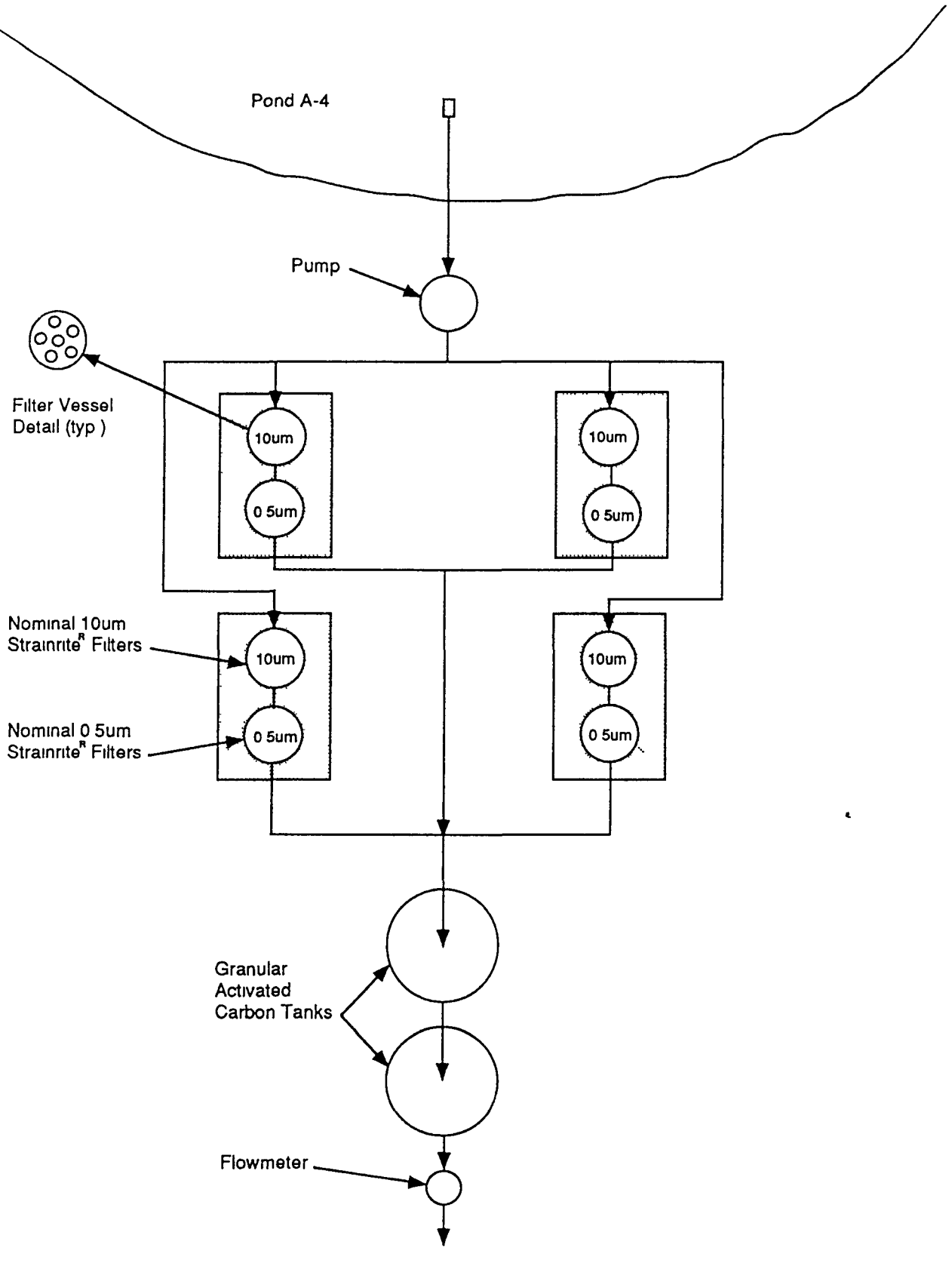
In response to the new radiochemical standards, RFP initiated an evaluation of treatment technologies potentially applicable to the removal of radiochemical contaminants in pond water This initial evaluation, which included both literature reviews and vendor contacts, concluded that the primary radionuclides of concern (plutonium and americium) were most likely associated with suspended particulate or colloidal material

(organics, silicates) in the ponds Therefore, RFP believed that reductions in radionuclide concentrations would result from treatment utilizing a filtration system capable of removing a significant percentage of the total suspended solids (particulate matter greater than 0 45 micron) This would theoretically result in a corresponding reduction in radionuclide levels

Therefore, a combined treatment system utilizing both particulate filtration and GAC adsorption has been employed since March 1990 in an attempt to remove trace levels of both organic and radionuclide contaminants (Figure 1) The average monthly cost of treatment is $266,000 The treatment system also generates waste in the form of spent filters and large quantities of used carbon requiring regeneration Both these materials have posed waste management difficulties for RFP

Water from Pond B-5 is currently transferred to Pond A-4 for treatment, and discharges from Pond A-4 are currently treated and discharged into Walnut Creek Under current operations, all water passing through the treatment systems is recirculated (without discharge) to the source pond until analytical results for predischarge samples are received The effluent is diverted by Broomfield to the Broomfield Diversion Ditch (BDD), beginning on the east side of Indiana Street The BDD discharges into Walnut Creek below Great Western Reservoir, therefore, the Reservoir has not been affected by recent discharges of Ponds A-4, B-5, or C-2

Water from Pond C-2 has been treated and conveyed overland and northeast by pipeline to the BDD The onsite, piped diversion was approved by EPA, and the water release to the BDD was negotiated with the City of Broomfield The diversion pipeline from the Woman Creek to Walnut Creek drainage was completed at the request of the City of Westminster Water from the diversion pipeline entered the BDD, which was already in place, however, EPA approval to convey the water from Pond C-2 to BDD ended December 1990 Renegotiation of the use of the conveyance pipe to the BDD has recently (June 1991) been accomplished with EPA All parties have agreed to a discharge from Pond C-2 of untreated water based on predischarge sampling and analysis that indicated the water met all quality requirements except the Woman Creek gross beta standard However, the gross beta analysis did meet Walnut Creek standards where the discharge is directed



Pond A-4 Water Treatment Schematic

FIGURE 1

2 3 Pond Water Analysis

Currently, key pre-discharge samples (and many others) for both raw and treated pond water are analyzed independently by CDH, RFP, and an offsite contractor to RFP Collected samples are split and preserved as appropriate for transport to onsite and offsite laboratories RFP offsite contracted laboratories currently use RFP's General Radiochemistry and Routine Analytical Services Protocol (GRRASP)

Table 1 summarizes the routine analytical procedures and frequencies currently performed by offsite contract laboratories for RFP terminal pond water The average cost for one set of samples for analysis by all methods listed is approximately $10,000 The analytical methods listed in Table 1, i e , Organic Volatiles - Method 624, refer to EPA guidelines establishing procedures for the analysis of pollutants A complete description of each method is presented in the Code of Federal Regulations, 40 CFR - Part 136

Table 1

Analytical Parameters and Frequencies

Performed by Offsite Laboratories

Parameter	Sampling Frequency During Discharge*	Routine In-Pond Characterization
Volatile Organics Method 624	Weekly	Weekly
Semi-Volatile Organics Method 625	- - -	Monthly
Selected Organics Method 502 2	- - -	Monthly
Triazine Herbicides Method 619	Weekly	Weekly
Polynuclear Aromatic Hydrocarbons (PAH) Method 610	- - -	Monthly
Chlorinated Pesticides Method 615	- - -	Monthly
Pesticides/PCB Method 608	- - -	Monthly
Dissolved Radionuclides	- - -	Weekly
Total Radionuclides	Weekly	Monthly
Total Suspended Solids	Weekly	Weekly
Nitrate/Nitrite (as N)	Weekly	Weekly
Dissolved Metals	- - -	Weekly
Tritium	Weekly	Weekly
Acute Toxicity	- - -	Monthly
Total Metals	- - -	Monthly
Dioxin Method 613	- - -	Monthly
Gross Alpha	Weekly	Weekly
Gross Beta	Weekly	Weekly

* Weekly samples will include additional parameters in conjunction with weekly CDH split sampling

Table 2 summarizes the routine analytical procedures and frequencies currently performed on RFP terminal pond water by RFP onsite laboratories

Table 2
Analytical Parameters and Frequencies
Performed by Onsite Laboratories

Parameter	Sampling Frequency During Discharge	Routine In-Pond Characterization
Total Gross Alpha	Daily	Weekly
Total Gross Beta	Daily	Weekly
Plutonium-239,240 (total)	2-day/5-day composites	- - -
Americium-241 (total)	2-day/5-day composites	- - -
Uranium-234, 238 (total)	2-day/5-day composites	- - -
Volatile Organics	- - -	Quarterly
Nitrate (as N)	Daily	Weekly
Total Suspended Solids /Non-Volatile Suspended Solids	Daily	Weekly
Tritium	Daily	Weekly

Accurate determinations of extremely low radionuclide concentrations require prolonged sample turnaround times, many parameters routinely exceed two weeks for onsite determinations and are frequently greater than 66 days for offsite laboratories (GRRASP requirement) Similarly, RFP offsite contract laboratories have 45 days to report organic and inorganic analytical results to RFP

2 4 Pond Elevations

As previously discussed, monitoring and control of pond water to ensure all CWQCC stream standards are met has resulted in significant delays in discharging surface water runoff from the RFP ponds In addition to the extremely unpredictable inflow of surface water runoff, the RFP pond system must accommodate a more predictable inflow averaging 220,000 gallons per day of treated sanitary effluent from the RFP Sewage Treatment Plant This source of water was previously (prior to February 1990) primarily spray irrigated rather than discharged to the RFP terminal ponds Together these operational modifications to pond use have made water management much more challenging

A primary function of the holding ponds is to provide storage capacity for runoff from large storm events The ponds were designed to maintain volumes of 10 percent or less to ensure sufficient storage capacity for a 100-year storm event However, since August 1989, RFP has not been able to consistently maintain the 10 percent storage level, due predominantly to analytical turnaround times required to demonstrate the CWQCC standards, the additional quantities of detained STP effluent water in the pond system, and the time required to treat the large volumes of water prior to discharge

Table 3 lists the maximum capacities and design capacities for the RFP terminal ponds

Table 3
RFP Terminal Pond Capacities

Pond Location	Maximum Pond Capacity	Design Capacity (10% Capacity)
A-4	31,000,000 Gal	3,100,000 Gal
B-5	23,000,000 Gal	2,300,000 Gal
C-2	22,500,000 Gal	2,250,000 Gal

Figures 2-4 show volumes of the terminal ponds since August 1989 RFP's current operational goal is to maintain the ponds below 50 percent of total pond capacity

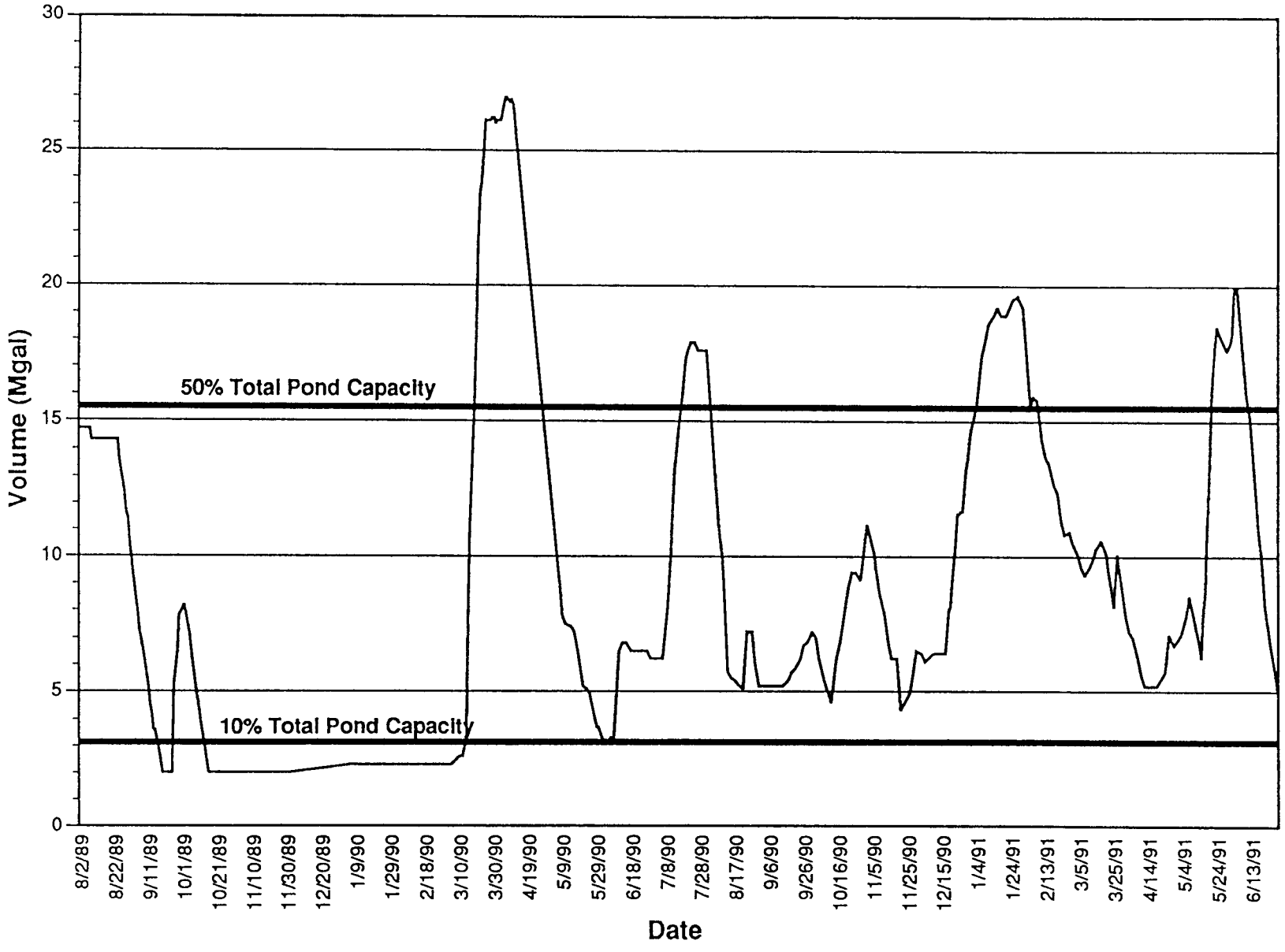


FIGURE 2: POND A-4 VOLUME AS A FUNCTION OF TIME

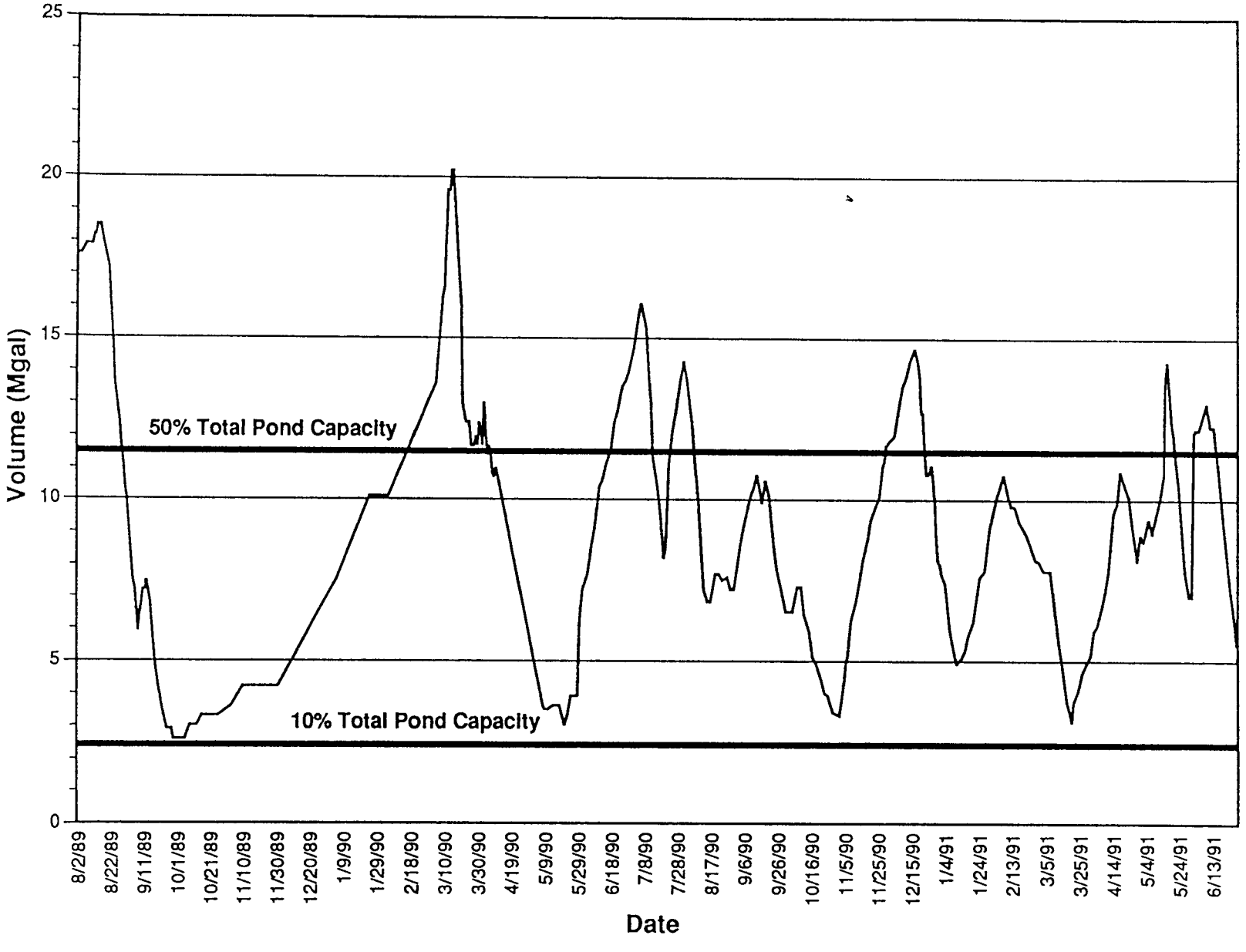


FIGURE 3: POND B-5 VOLUME AS A FUNCTION OF TIME

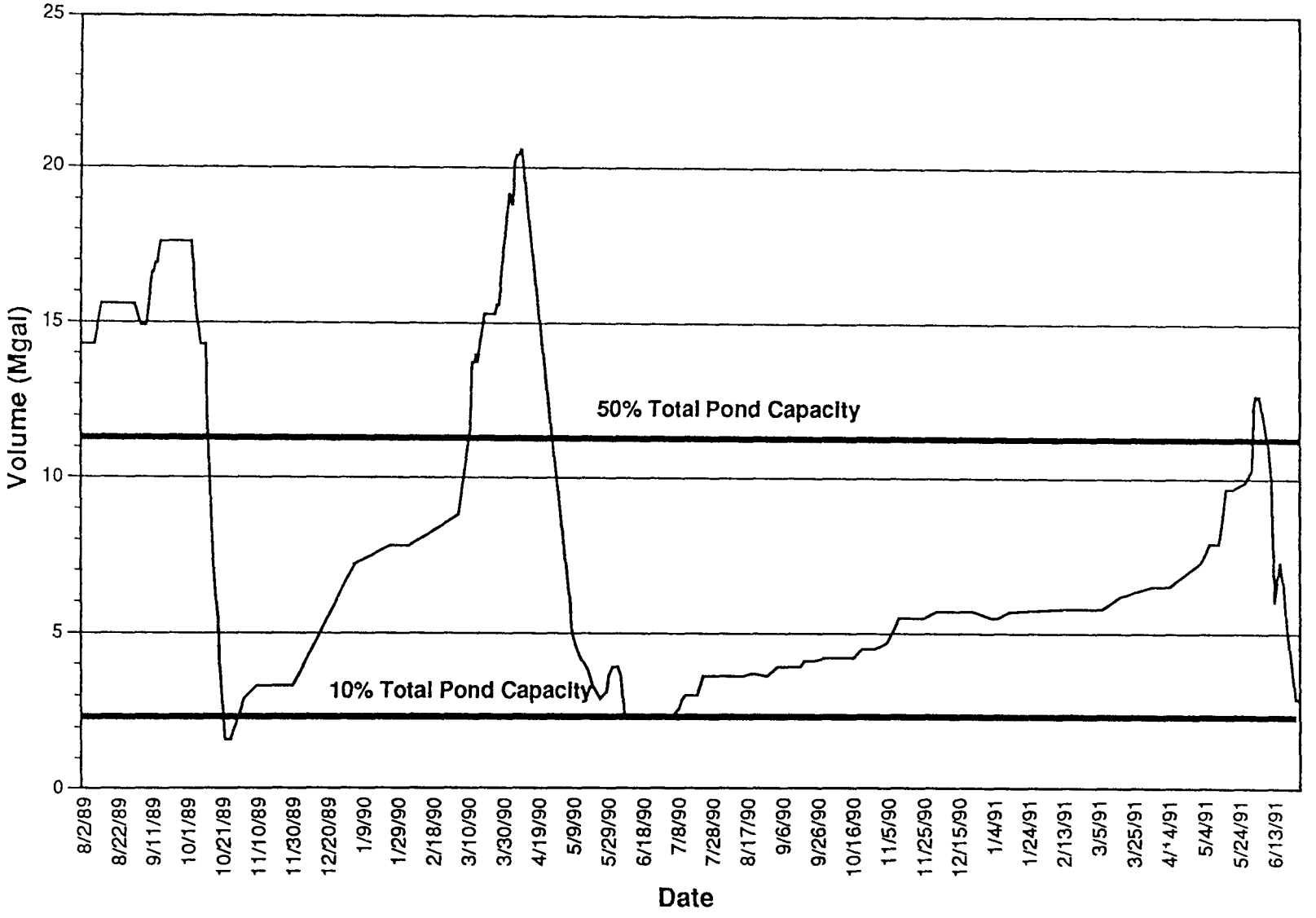


FIGURE 4: POND C-2 VOLUME AS A FUNCTION OF TIME

3 0 Results and Discussion

Data showing the quality of untreated and treated RFP terminal pond water available for 1990 and the first quarter of 1991 is summarized in the following sections Water quality in the terminal ponds is evaluated as a function of sample location (Pond A-4, B-5, or C-2), degree of treatment (untreated water, filtered water, or fully treated water), and analytical method

3 1 Untreated/Treated Pond Water Comparison

The first water quality data summary compares the number of detectable concentrations of organics and the number of exceedances of standards for radionuclides with the total number of analytes evaluated for each analytical method (Appendix I) Only sample results for organics and radionuclides were evaluated, as the current pond water treatment systems are expected to have a significant impact only on these suites of parameters

Where specific standards have not been established, minimum detection limits were used to determined exceedance levels The commonly-used herbicides, atrazine and simazine, have individual CWQCC standards set for Segment 4 and those standards were used in the evaluation Radionuclide concentrations have been compared to the Segment 4 standards listed in Table 4

Table 4

CWQCC Stream Standards for Radiochemistry

Radionuclide	CWQCC Big Dry Creek Seg 4 Stream Standards (pCi/L)
Americium-241	0 05
Curium-244	6 0
Neptunium-237	3 0
Plutonium-239,240	0 05
Uranium-233,234,238*	5-10
Cesium-134	8 0
Radium-226,228	5
Strontium 90	8
Thorium-230,232	6 0
Tritium	500
Gross Alpha*	7-11
Gross Beta*	5-19

*Lower standard applies to Woman Creek, higher standard applies to Walnut Creek

For the organic chemicals, the detects/exceedances range from 0 to 5 percent of the total number of analytes evaluated for each method used (volatiles, semi-volatiles, pesticides, PCB's, herbicides, PAH's) The largest percentage (2 of 40) of analytes detected was for fully treated water at Pond A-4 for chlorinated pesticides (Method 615) Numerous (21 of 42) data groupings show no detectable concentrations of any analyte for the corresponding combinations of analytical method, degree of treatment, and pond location This includes all of the analyses for pesticides/PCB's(Method 608) and PAH compounds (Method 610)

For radionuclides, exceedances of the CWQCC standards range from 0 to 0 5 (1 of 211) percent for Pond A-4, 0 to 5 6 (1 of 18) percent for Pond B-5, and 16 1 (39 of 242) to 56 8 (42 of 74) percent for Pond C-2 Once again, numerous (9 of 12) data groupings show no exceedances for any analyte for the corresponding combinations of analytical method, degree of treatment, and pond location for Ponds A-4 and B-5 Nearly

all exceedances for Pond C-2 (243 of 246) are from gross alpha and gross beta analyses The exceedances for Pond C-2 can be attributed to the lower gross alpha and beta standards for Woman Creek as compared to Walnut Creek

3 2 Detects/Exceedances of Organic Contaminants

A second data evaluation consists of a simple summary of the number of detects/exceedances and maximum value for each organic parameter that was either detected or exceeded standards within each analytical method (Tables 5-7) As previously discussed in Section 3 1, exceedances/detects were few (24 for Pond A-4, 39 for Pond B-5, and 21 for Pond C-2) and minor (26 ug/L maximum for Pond A-4, 18 ug/L maximum for Pond B-5, and 86 ug/L maximum for Pond C-2)

Even though the percentage of organic analytes detected were small, many of the values are of a questionable nature, i e , methylene chloride is a common lab contaminant, chloroform will result from chlorination of one feed stream (Sewage Treatment Plant effluent) to Pond B-5, many parameters were detected at all locations on a single day, etc It is reasonable to expect the actual number of detects/exceedances to be even less than the numbers provided

Additionally, the concentration of atrazine in the RFP terminal pond waters—the initial driver for implementing the GAC treatment system—is no longer of concern Figures 5 and 6 show that the levels of atrazine in the terminal ponds have consistently remained below the CWQCC standard of 3 ug/L for the past 12 months

3 3 Radionuclide Data Summary

A third data evaluation summarizes the mean values and upper 95% confidence limits for the principal radiochemistry at RFP, i e , plutonium, uranium, americium, gross alpha, and gross beta (Tables 8-10) Once again, the data have been grouped by pond location (A-4, B-5, or C-2), by degree of water treatment (untreated, filtered, or fully treated), and by laboratory procedure (total or dissolved) In this evaluation, radionuclide data from the RFP on-site laboratory have been included for comparative purposes

TABLE 5 POND A-4 ORGANIC ANALYTES WITH DETECTABLE CONCENTRATIONS

Parameter	Untreated Water			Filtered Water			Fully Treated Water		
	Number of Samples	Number of Detects	Maximum (ug/L)	Number of Samples	Number of Detects	Maximum (ug/L)	Number of Samples	Number of Detects	Maximum (ug/L)
Volatile Organics-Method 624									
1,1,1-TCA	54	1	8	11	0	---	53	1	10
Methylene Chloride	55	3	10	11	0	---	56	3	12
PCE	54	1	7	11	0	---	53	1	14
TCE	54	1	7	11	0	---	53	1	26
Semi-Volatile Organics-Method 625									
Bis(2 ethylhexyl)phthalate	13	1	11	- -	---	---	12	1	19
Selected Organics-Method 502 2									
1,1 DCE	12	0	---	---	---	---	4	1	0 71
Triazine Herbicides-Method 619									
Atrazine	37	3	3 90	6	0	---	32	0	---
Chlorinated Pesticides-Method 615									
Dicamba	11	4	2 10	---	---	---	4	2	1 10
PAH Compounds-Method 610									
No Detects	144	0	---	---	---	---	32	0	--
Pesticides/PCB's Method 608									
No Detects	271	0	---	---	---	---	173	0	-

TABLE 6 POND B-5 ORGANIC ANALYTES WITH DETECTABLE CONCENTRATIONS

Parameter	Untreated Water			Filtered Water			Fully Treated Water		
	Number of Samples	Number of Detects	Maximum (ug/L)	Number of Samples	Number of Detects	Maximum (ug/L)	Number of Samples	Number of Detects	Maximum (ug/L)
Volatile Organics-Method 624									
1 1 1 TCA	68	1	10	4	0		30	1	8 4
Methylene Chloride	72	8	18	4	0	-	32	2	8
PCE	68	1	11	4	0	--	30	1	6
TCE	68	1	11	4	0	--	29	1	6
Semi Volatile Organics Method 625									
Bis(2 ethylhexyl)phthalate	16	1	11	-	---	-	5	0	
Selected Organics-Method 502 2									
1 1,1 TCA	14	1	0 24				2	0	
Carbon Tetrachloride	14	1	0 28				2	0	
Chloroform	14	7	1 20				2	0	
PCE	14	2	0 76				2	0	-
TCE	14	2	2 10	- -	-	-	2	0	-
Triazine Herbicides-Method 619									
Atrazine	42	1	3 83				12	0	
Propazine	34	1	2 40				8	0	
Terbuthylazine	29	1	1 40				8	0	-
Simetryn	34	0	-	- -	- -	--	9	1	0 64
Chlorinated Pesticides Method 615									
Dicamba	14	4	0 80	-	-	- -	3	1	0 29
PAH Compounds Method 610									
No Detects	192	0	-	- -	---	-	16	0	
Pesticides/PCB s Method 608									
No Detects	345	0		---	---	-	77	0	

TABLE 7 POND C-2 ORGANIC ANALYTES WITH DETECTABLE CONCENTRATIONS

Parameter	Untreated Water			Filtered Water			Fully Treated Water		
	Number of Samples	Number of Detects	Maximum (ug/L)	Number of Samples	Number of Detects	Maximum (ug/L)	Number of Samples	Number of Detects	Maximum (ug/L)
Volatile Organics-Method 624									
1 1 1-TCA	55	1	7	5	0	--	20	0	--
Methylene Chloride	55	5	12	5	0	--	22	3	12
PCE	55	1	13	5	0	---	20	0	--
TCE	55	1	6	5	0	--	20	0	-
Toluene	55	1	6	6	1	6	20	0	--
Total Xylenes	54	1	15	5	0	--	20	1	6
Semi-Volatile Organics-Method 625									
Bis(2 ethylhexyl)phthalate	12	3	44	---	---	---	6	1	86
Selected Organics-Method 502 2									
1,1,1-TCA	11	0	---				3	1	0 83
PCE	11	0	---	---	---	-	3	1	0 34
Triazine Herbicides-Method 619									
No Detects	247	0	---	---	---	---	28	0	- -
Chlorinated Pesticides-Method 615									
No Detects	110	0	---	---	---	--	30	0	---
PAH Compounds-Method 610									
No Detects	144	0	---	---	--	-	32	0	-
Pesticides/PCB's-Method 608									
No Detects	298	0	---	---	---	---	75	0	

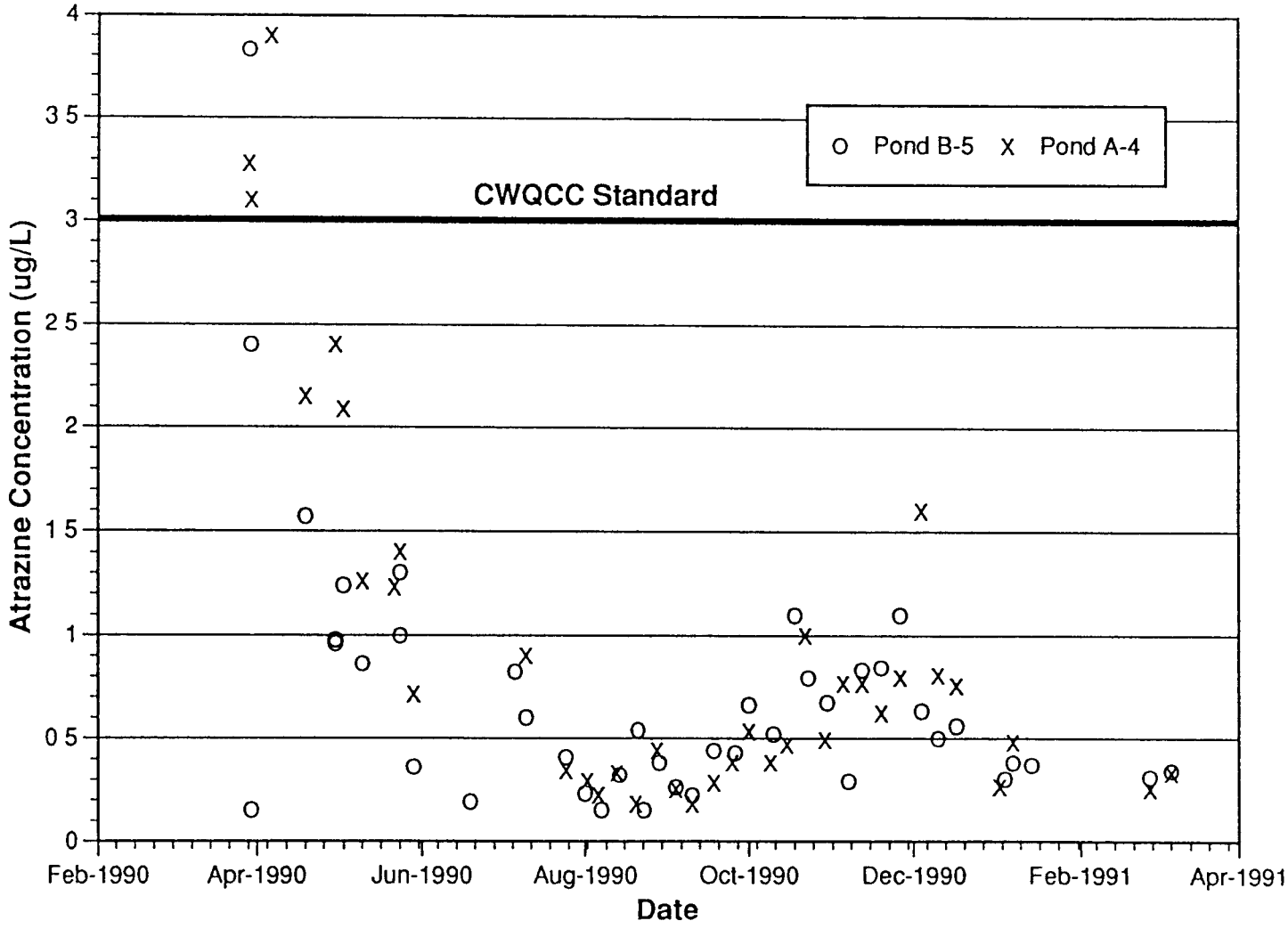


FIGURE 5: ATRAZINE CONCENTRATIONS IN PONDS A-4 AND B-5

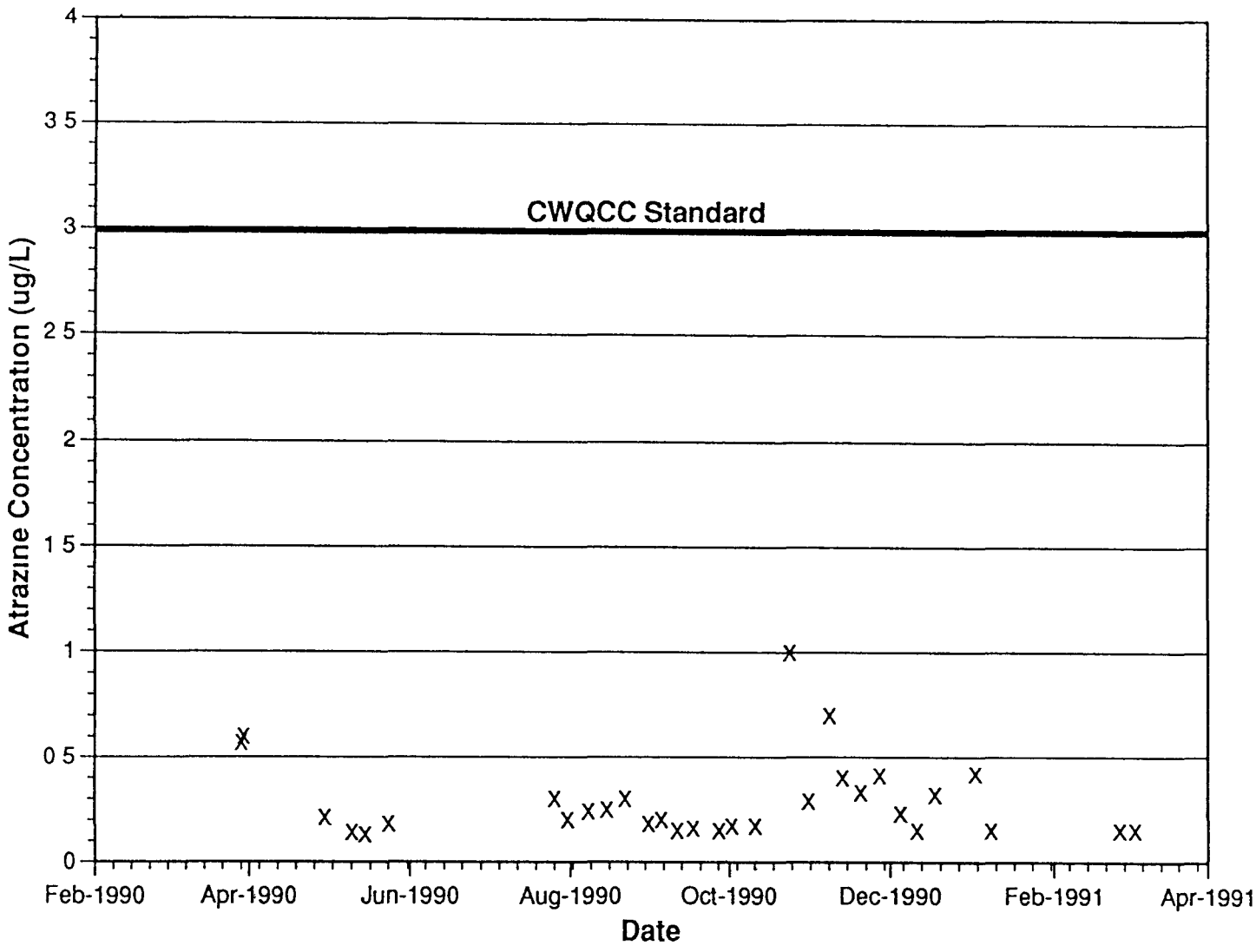


FIGURE 6: ATRAZINE CONCENTRATIONS IN POND C-2

TABLE 8 POND A-4 RADIOCHEMISTRY DATA SUMMARY

Parameter	CWQCC STREAM STANDARDS (pCi/L)	UNTREATED WATER # of Samples/ Exceedances	Mean	**Upper 95% Confidence Limit	FILTERED WATER # of Samples/ Exceedances	Mean	Upper 95% Confidence Limit	FULLY TREATED WATER # of Samples/ Exceedances	Mean	*Upper 95% Confidence Limit
Gross Alpha (Dissolved)	11	33/1	3 6±1 9	4 3	21/0	5 5±2 4	6 4	17/0	4 2±2 0	5 1
Gross Alpha (Total)	11	61/0	5 3±2 5	5 6	63/0	4 8±2 5	5 1	162/1	2 8±1 9	3 1
Gross Alpha (Total)	11	53/0	3 3±1 0	3 7	—	—	—	243/0	2 3±1 0	2 4
Gross Beta (Dissolved)	19	33/0	6 9±1 5	7 5	21/0	5 5±1 3	6 0	17/0	4 6±1 4	5 2
Gross Beta (Total)	19	61/0	5 2±1 4	5 5	63/0	5 1±1 4	5 2	162/0	6 4±1 4	6 6
Gross Beta (Total)	19	53/0	9 8±1 2	10 2	--	---	--	243/1	9 3±1 4	9 5
Plutonium 239 240 (Dissolved)	0 05	18/0	0 004±0 006	0 005	4/0	0 001±0 007	0 005	—	—	—
Plutonium 239 240 (Total)	0 05	5/0	0 007±0 007	0 011	—	—	—	16/0	0 006±0 006	0 008
Plutonium 239 240 (Total)	0 05	6/0	-0 003±0 026	0 005	—	—	—	53/0	-0 002±0 032	0 001
Americium 241 (Dissolved)	0 05	18/0	0 002±0 006	0 004	4/0	0 001±0 005	0 004	—	—	—
Americium 241 (Total)	0 05	4/0	0 008±0 009	0 016	—	—	—	17/0	0 003±0 007	0 007
Americium 241 (Total)	0 05	5/0	0 013±0 052	0 037	—	—	—	54/5	0 009±0 039	0 015
Uranium 233 234 (Dissolved)	10	19/0	1 34±0 50	1 65	4/0	1 10±0 46	1 44	—	—	–
Uranium 233 234 (Total)	10	9/0	2 39±0 61	3 09	—	—	—	18/0	1 14±0 40	1 44
Uranium 238 (Dissolved)	10	19/0	1 67±0 57	2 11	4/0	1 01±0 43	1 29	—	—	—
Uranium 238 (Total)	10	9/0	2 55±0 62	3 34	—	—	—	17/0	1 21±0 42	1 55
Uranium 234 238 (Total)	10	6/2	3 82	5 82	—	—	—	53/0	2 46±0 31	2 88

Rocky Flats Plant laboratories All other results from off site contractor laboratories

Confidence limits are based on the student s t distribution assuming normality

TABLE 9 POND B-5 RADIOCHEMISTRY DATA SUMMARY

Parameter	CWQCC STREAM STANDARDS (pCi/L)	UNTREATED WATER # of Samples/ Exceedances	Mean	**Upper 95% Confidence Limit	FILTERED WATER # of Samples/ Exceedances	Mean	Upper 95% Confidence Limit	FULLY TREATED WATER # of Samples/ Exceedances	Mean	Upper 95% Confidence Limit
Gross Alpha (Dissolved)	11	33/0	2 6±1 7	3 2	5/0	4 4±2 4	5 8	9/1	6 5±2 6	9 5
Gross Alpha (Total)	11	56/0	4 6±2 5	5 0	35/0	4 8±2 5	5 4	71/0	2 9±1 9	3 3
*Gross Alpha (Total)	11	53/0	2 1±1 0	2 2	—	—	—	69/0	2 0±1 0	2 3
Gross Beta (Dissolved)	19	33/0	8 2±1 6	8 8	5/0	7 4±1 5	8 7	9/0	6 3±1 7	7 5
Gross Beta (Total)	19	56/0	7 8±1 5	8 1	34/0	7 2±1 5	7 7	69/0	7 2±1 5	7 5
Gross Beta (Total)	19	53/0	11 2±1 3	11 6	—	—	—	69/0	8 8±1 3	9 0
Plutonium 239 240 (Dissolved)	0 05	18/0	0 006±0 007	0 008	—	—	—	—	—	—
Plutonium 239 240 (Total)	0 05	6/0	0 005±0 006	0 010	—	—	—	7/0	0 004±0 007	0 007
*Plutonium 239 240 (Total)	0 05	5/0	-0 001±0 046	0 010	—	—	—	26/0	-0 001±0 035	0 005
Amencium 241 (Dissolved)	0 05	17/0	0 008±0 008	0 013	—	—	—	—	—	-
Amencium 241 (Total)	0 05	5/0	0 004±0 010	0 016	—	—	—	6/0	0 000±0 006	0 005
Amencium 241 (Total)	0 05	5/0	0 002±0 035	0 015	—	—	—	24/1	0 006±0 043	0 013
Uranium 233 234 (Dissolved)	10	20/0	0 89±0 41	1 14	—	—	—	—	—	
Uranium 233 234 (Total)	10	5/0	1 46±0 41	2 74	—	—	—	7/0	0 71±0 27	1 25
Uranium 238 (Dissolved)	10	20/0	0 72±0 35	0 91	—	—	—	—	—	—
Uranium 238 (Total)	10	5/0	1 20±0 37	2 15	—	—	—	7/0	0 63±0 26	1 08
Uranium 234 238 (Total)	10	5/0	2 28	4 31	—	—	—	26/0	2 45±0 26	3 06

Rocky Flats Plant laboratories All other results from off site contractor laboratories

Confidence limits are based on the student s t distribution, assuming normality

TABLE 10 POND C-2 RADIOCHEMISTRY DATA SUMMARY

Parameter	CWQCC STREAM STANDARDS (pCi/L)	UNTREATED WATER # of Samples/ Exceedances	UNTREATED WATER Mean	UNTREATED WATER Upper 95% Confidence Limit	FILTERED WATER # of Samples/ Exceedances	FILTERED WATER Mean	FILTERED WATER * Upper 95% Confidence Limit	FULLY TREATED WATER # of Samples/ Exceedances	FULLY TREATED WATER Mean	FULLY TREATED WATER Upper 95% Confidence Limit
Gross Alpha (Dissolved)	7	35/3	3 1±1 9	3 8	7/0	4 7±2 5	5 7	14/0	3 6±2 0	4 2
Gross Alpha (Total)	7	62/10	5 1±2 5	5 5	37/5	5 3±2 5	5 7	75/2	3 6±2 0	3 9
Gross Alpha Basin (Total)	7	—	—	—	—	—	—	49/0	3 1±1 0	3 5
Gfoss Alpha (Total)	7	50/3	3 4±1 1	3 8	—	—	—	40/0	3 5±1 1	3 9
Gross Beta (Dissolved)	5	35/33	6 7±1 5	7 2	7/7	6 5±1 4	7 0	14/14	6 4±1 7	7 0
Gross Beta (Total)	5	62/62	7 5±1 5	7 8	37/37	7 0±1 4	7 3	74/70	6 5±1 4	6 7
Gross Beta Basin (Total)	5	—	—	—	—	—	—	49/49	9 0±1 2	9 2
Gross Beta (Total)	5	50/49	8 8±1 4	9 3	—	—	—	40/40	9 2±1 4	9 5
Plutonium 239 240 (Dissolved)	0 05	23/0	0 006±0 006	0 007	—	—	—	—	—	-
Plutonium 239 240 (Total)	0 05	10/2	0 030±0 013	0 042	—	—	—	—	—	—
Plutonium 239 240 Basin (Total)	0 05	—	—	—	—	—	—	15/1	0 013±0 039	0 023
Plutonium 239 240 (Total)	0 05	2/1	0 046±0 053	0 111	—	—	—	13/0	0 012±0 040	0 022
Amencium 241 (Dissolved)	0 05	19/0	0 008±0 009	0 012	—	—	—	—	—	—
Amencium 241 (Total)	0 05	5/1	0 021±0 010	0 052	—	—	—	4/0	-0 002±0 008	0 001
Amencium 241 Basin (Total)	0 05	—	—	—	—	—	—	15/0	-0 001±0 040	0 007
Amencium 241 (Total)	0 05	2/0	0 029±0 054	0 076	—	—	—	13/0	-0 001±0 039	0 006
Uranium 233 234 (Dissolved)	5	23/0	1 21±0 50	1 34	—	—	—	—	—	—
Uranium 233 234 (Total)	5	6/0	1 28±0 45	1 99	—	—	—	—	—	—
Uranium 238 (Dissolved)	5	23/0	1 32±0 52	1 50	—	—	—	—	—	—
Uranium 238 (Total)	5	6/0	1 65±0 49	2 64	—	—	—	—	—	—
*Uranium 234 238 Basin (Total)	5	—	—	—	—	—	—	15/2	3 18±0 31	3 90
Uranium 234 238 (Total)	5	2/0	4 06	4 24	—	—	—	13/1	3 76±0 29	4 28

*Rocky Flats Plant laboratories All other results from off site contractor laboratories

Confidence limits are based on the student's t distribution assuming normality

The tables show that with the exception of Pond C-2 gross alpha, gross beta, and uranium (which all have standards that are lower for Woman Creek than Walnut Creek), only nine exceedances have occurred and mean concentrations are below CWQCC standards Additionally, nearly all parameters have upper 95% confidence limits that fall below the CWQCC standards

4 0 Summary and Conclusions

Following the FBI/EPA raid in 1989, which called into question the environmental quality of RFP waters, an extensive sampling and analysis program was established to evaluate surface waters The Agreement in Principle between DOE and the State of Colorado and stringent site-specific stream standards imposed by the CWQCC led to multi-million dollar increases in both the RFP surface water treatment and monitoring programs The results of monitoring both untreated and treated water detailed in this report indicate that RFP surface waters are of uniformly high quality Plutonium, the contaminant of most concern to the average citizen, is routinely found at levels less than the CWQCC standard in both untreated and treated water samples The only consistent water quality issue is the nearly constant exceedance of gross alpha and gross beta stream standards in Pond C-2 There are no known operational contributions to gross beta parameters, since the major RFP contributors to water radiochemistry are alpha emitters

The data in this report strongly suggest that the monitoring and treatment programs should be revisited The extensive monitoring program has uncovered little to justify continuation at current commitment levels, particularly for analytes that are rarely detected and for which RFP is not a likely source Also, treatment of water that meets CWQCC standards should be reconsidered The establishment of a contingent treatment system, available in the case of spills and other incidents, appears more appropriate Storm control and spill control capacity have been substantially reduced by continued use of terminal ponds to store water for lengthy periods Data in this report do not justify continuing the current pond operation protocols which are counterproductive to storm and spill control

5 0 Recommendations

1) The treatment of water prior to discharge should be discontinued—provided instead on a contingency basis for removal of a pollutant(s) exceeding stream standards Discharge protocols would remain unchanged except for the use of the treatment systems Benefits of this change would include the reduction of both waste generation and cost, as well as potentially improving RFP's storm and spill control capabilities The change should be implemented with the concurrence of the regulators and the local municipalities

2) The RFP terminal pond water characterization/monitoring program should be drastically reduced—with concurrence from the State of Colorado and local cities—to recognize the contaminants of concern Table 11 provides a comparison of the current characterization program and the recommended changes to that program This approach is consistent with the Colorado discharge permit system that recognizes monitoring programs are limited by economic considerations and requires monitoring only for those pollutants shown to be of concern

Table 11 Suggested Reductions in
Sampling Frequencies
Performed by Offsite Laboratories

Parameter	Sampling Frequency During Discharge	Current Routine In-Pond Characterization	Proposed Routine In-Pond Characterization
Volatile Organics Method 624	Weekly	Weekly	Monthly
Semi-Volatile Organics Method 625	- - -	Monthly	Quarterly
Selected Organics Method 502 2	- - -	Monthly	Eliminate
Triazine Herbicides Method 619	Weekly	Weekly	Monthly
Polynuclear Aromatic Hydrocarbons (PAH) Method 610	- - -	Monthly	Annually
Chlorinated Pesticides Method 615	- - -	Monthly	Quarterly
Pesticides/PCB Method 608	- - -	Monthly	Annually
Dissolved Radionuclides	- - -	Weekly	Monthly
Total Radionuclides	Weekly	Monthly	Monthly
Total Suspended Solids	Weekly	Weekly	Monthly
Gross Alpha	Weekly	Weekly	Weekly
Gross Beta	Weekly	Weekly	Weekly

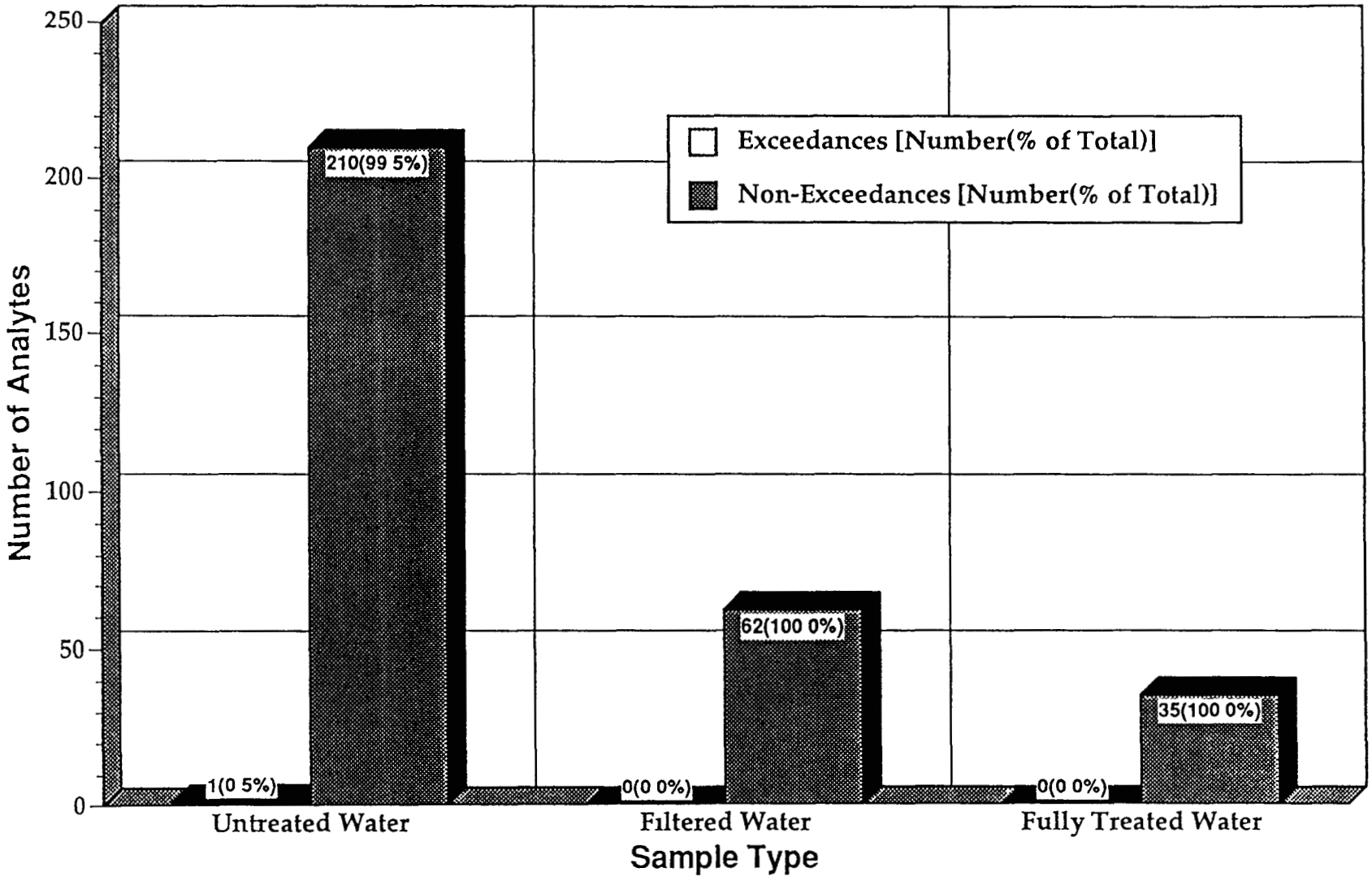


FIGURE 7: POND A-4 WATER QUALITY DATA SUMMARY - Dissolved Radiochemistry

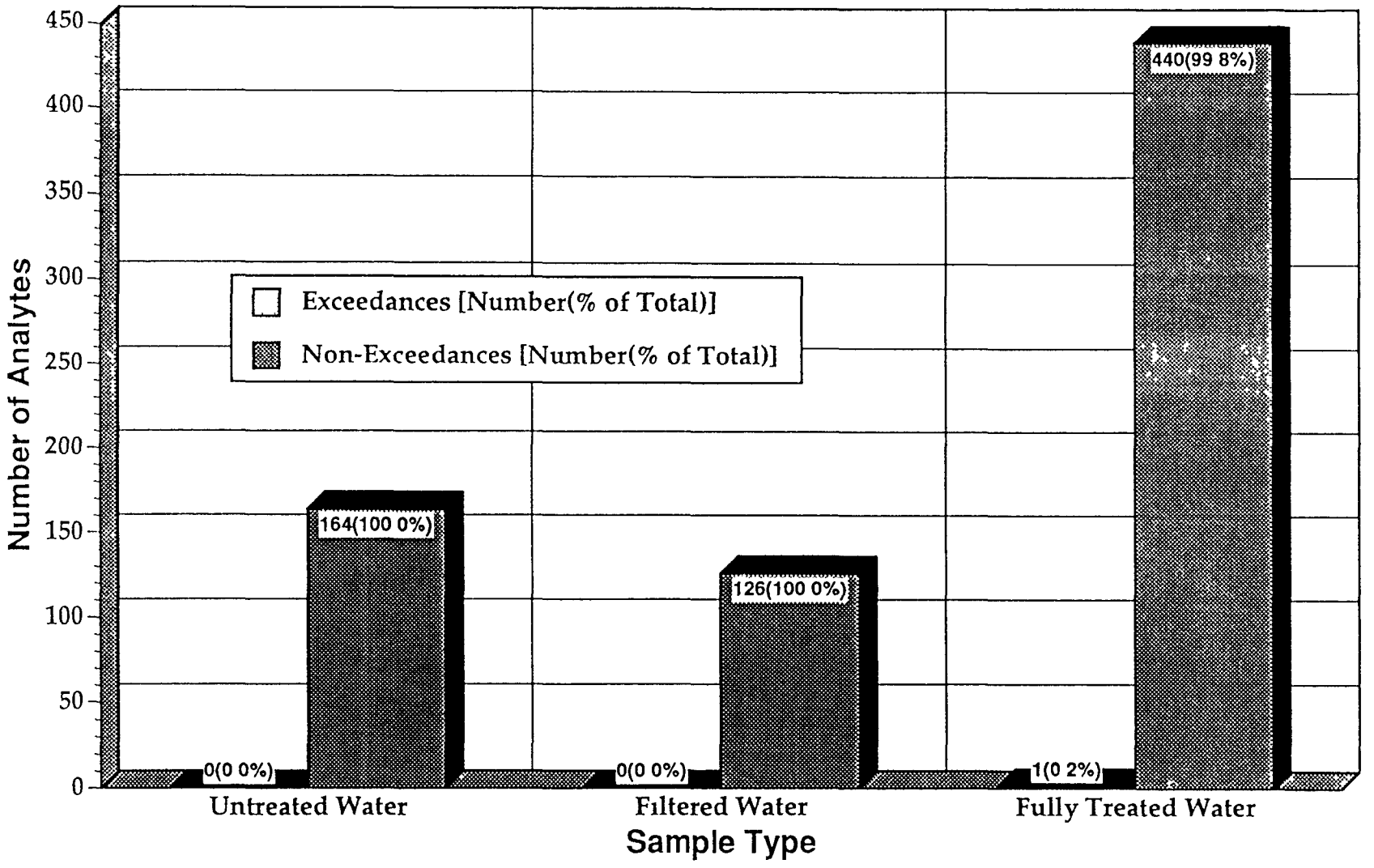


FIGURE 8· POND A-4 WATER QUALITY DATA SUMMARY - Total Radiochemistry

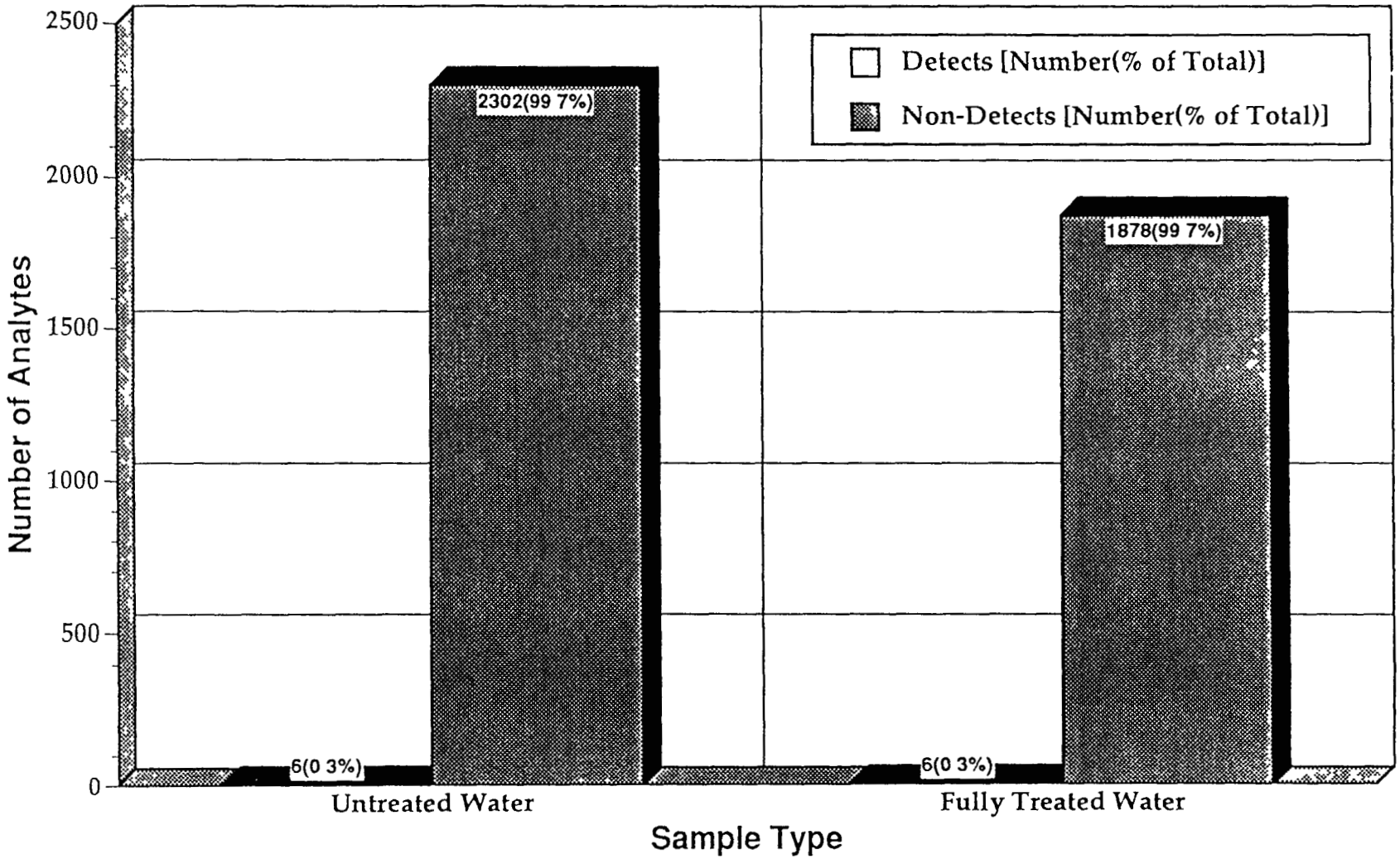


FIGURE 9 POND A-4 WATER QUALITY DATA SUMMARY - Volatile Organics (Method 624)

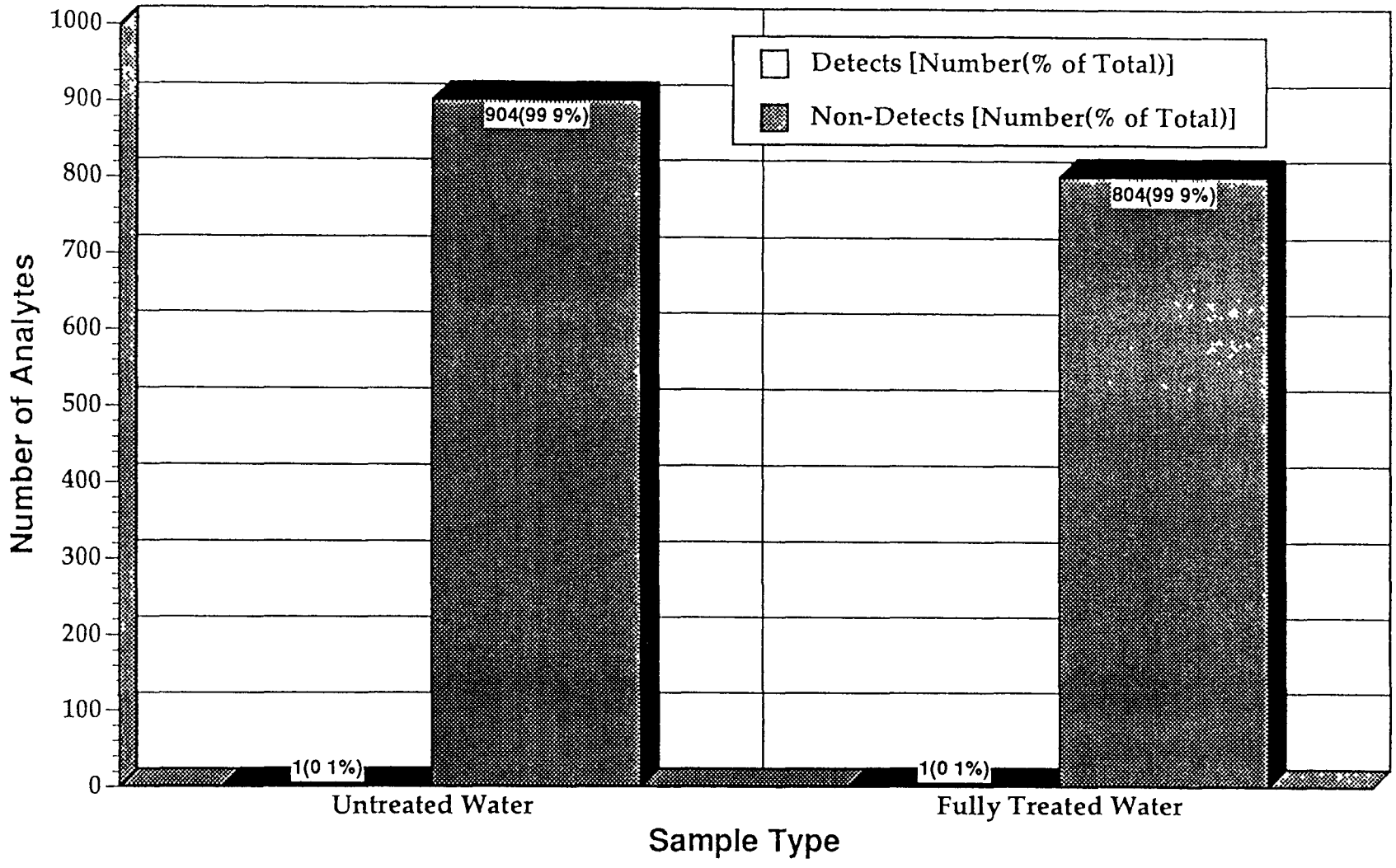


FIGURE 10 POND A-4 WATER QUALITY DATA SUMMARY - Semi-Volatile Organics (Method 625)

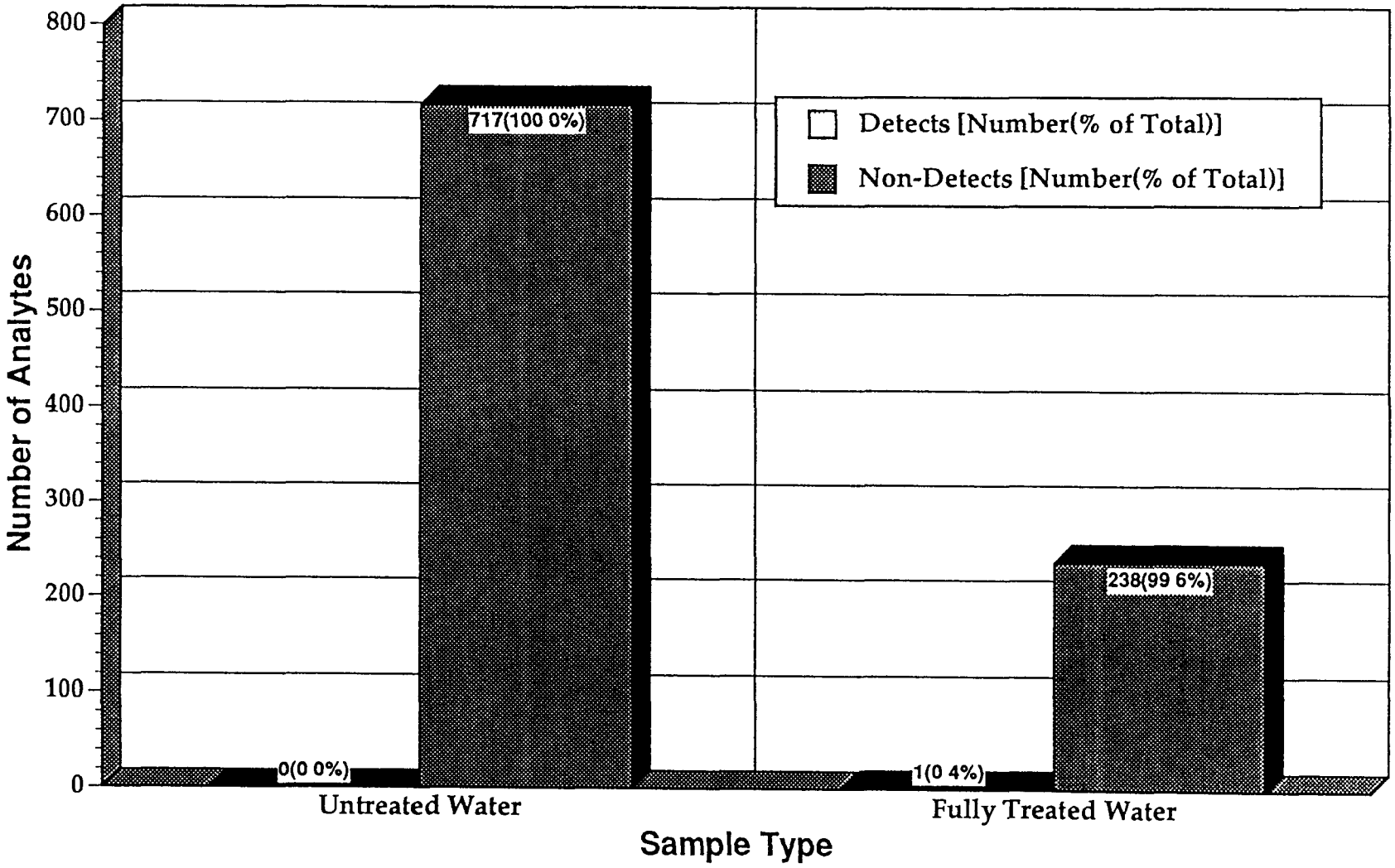


FIGURE 11: POND A-4 WATER QUALITY DATA SUMMARY - Selected Organics (Method 502.2)

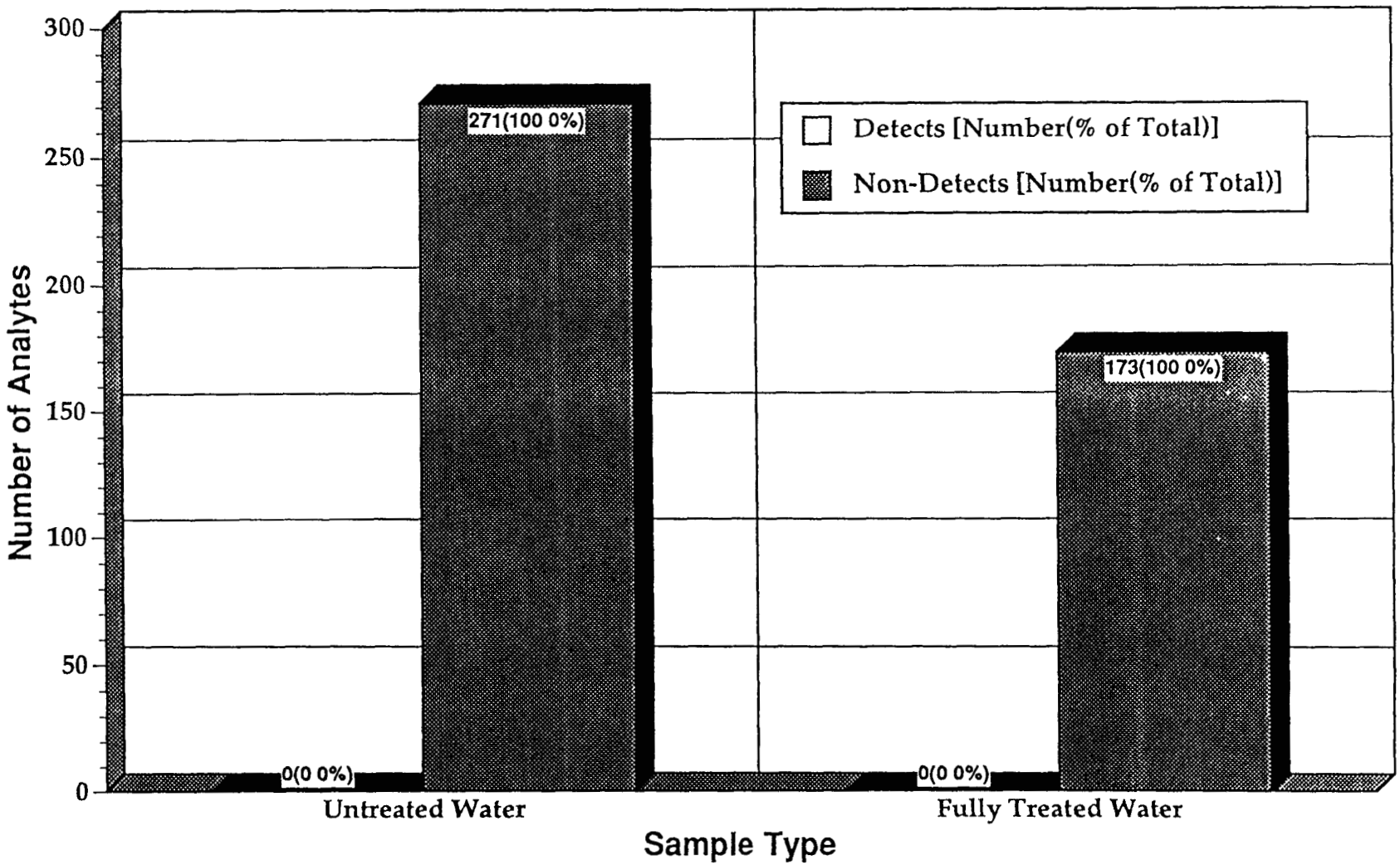


FIGURE 12: POND A-4 WATER QUALITY DATA SUMMARY - Pesticides/PCB's (Method 608)

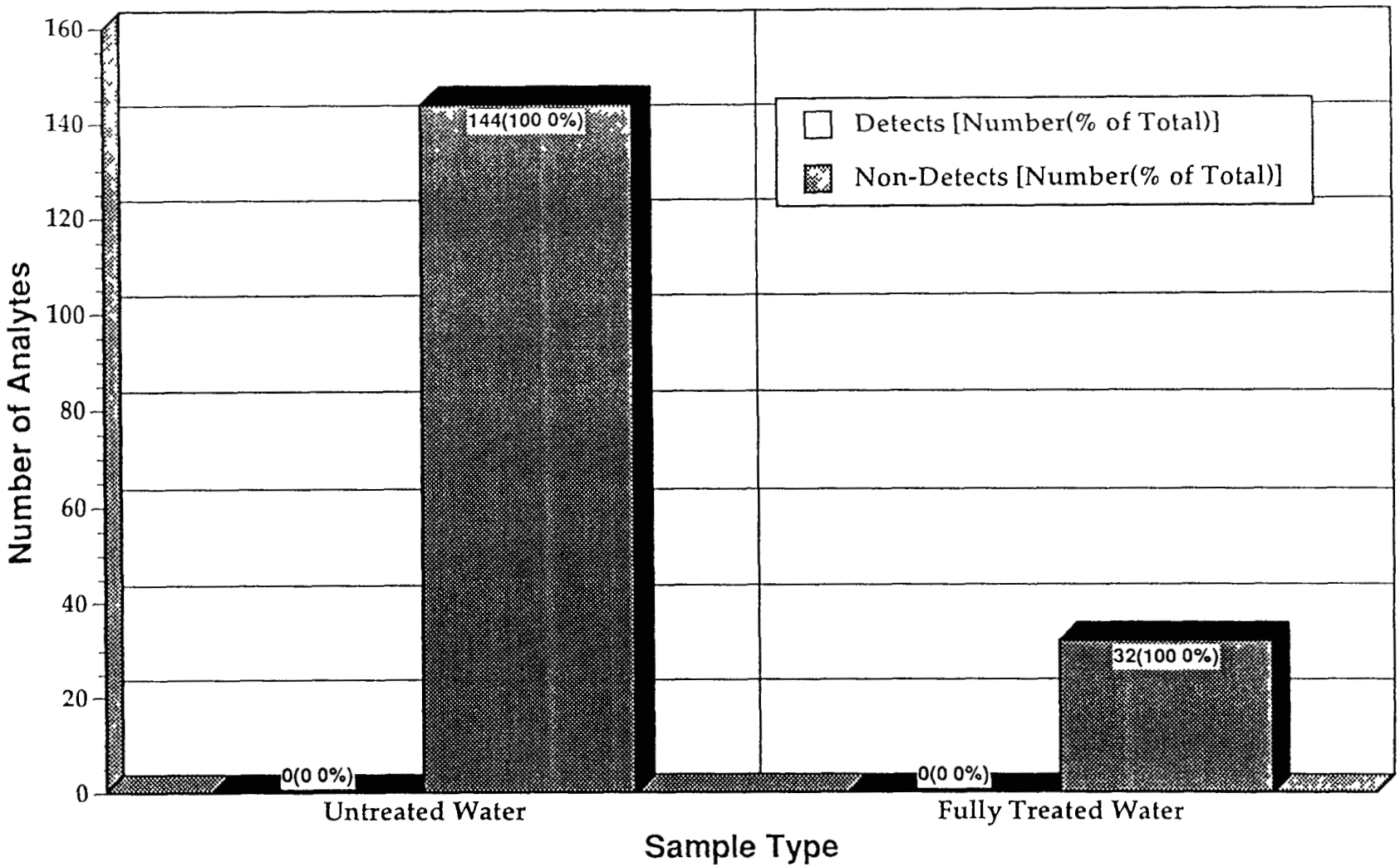


FIGURE 13 POND A-4 WATER QUALITY DATA SUMMARY - PAH Compounds (Method 610)

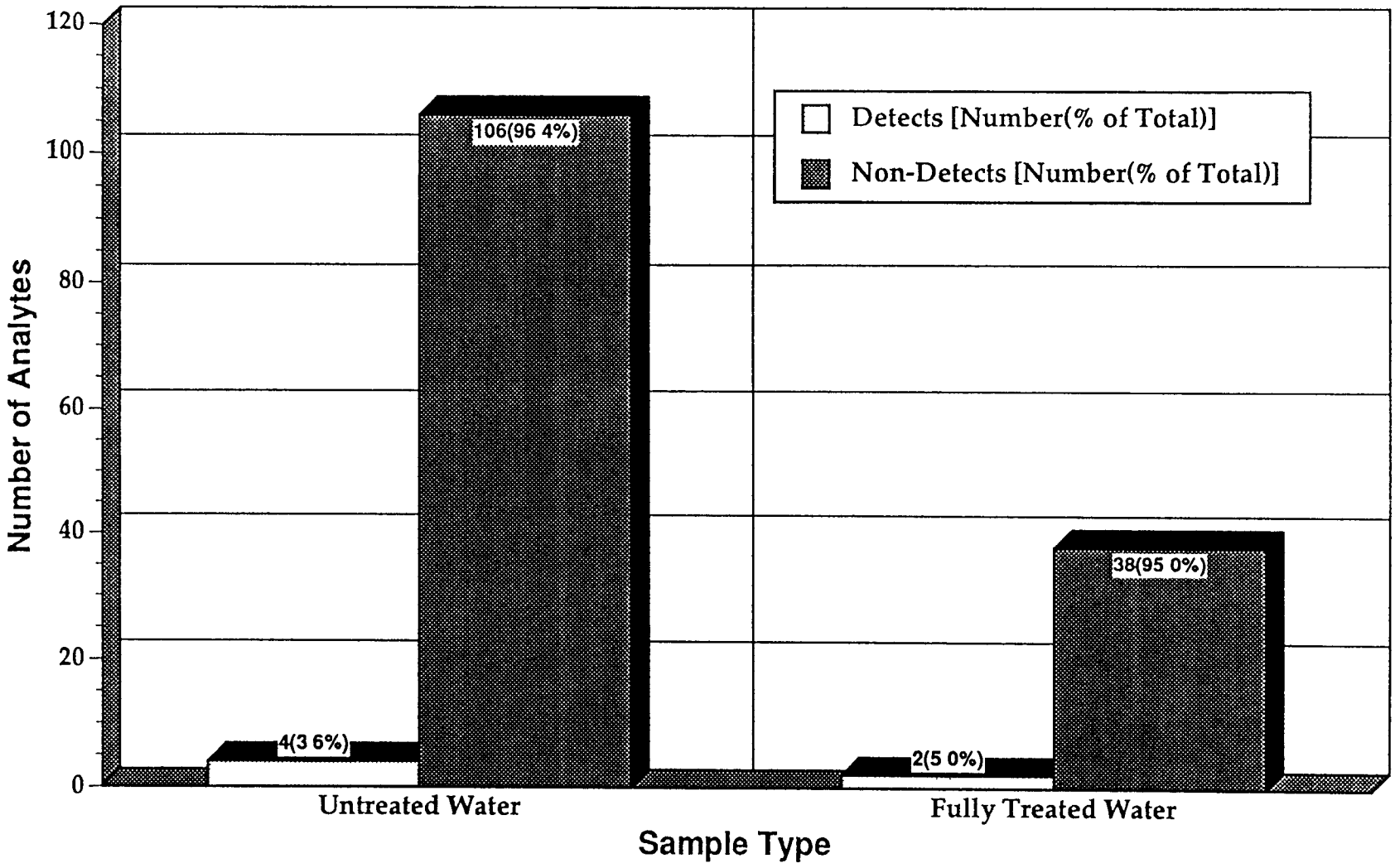


FIGURE 14: POND A-4 WATER QUALITY DATA SUMMARY - Chlorinated Pesticides (Method 615)

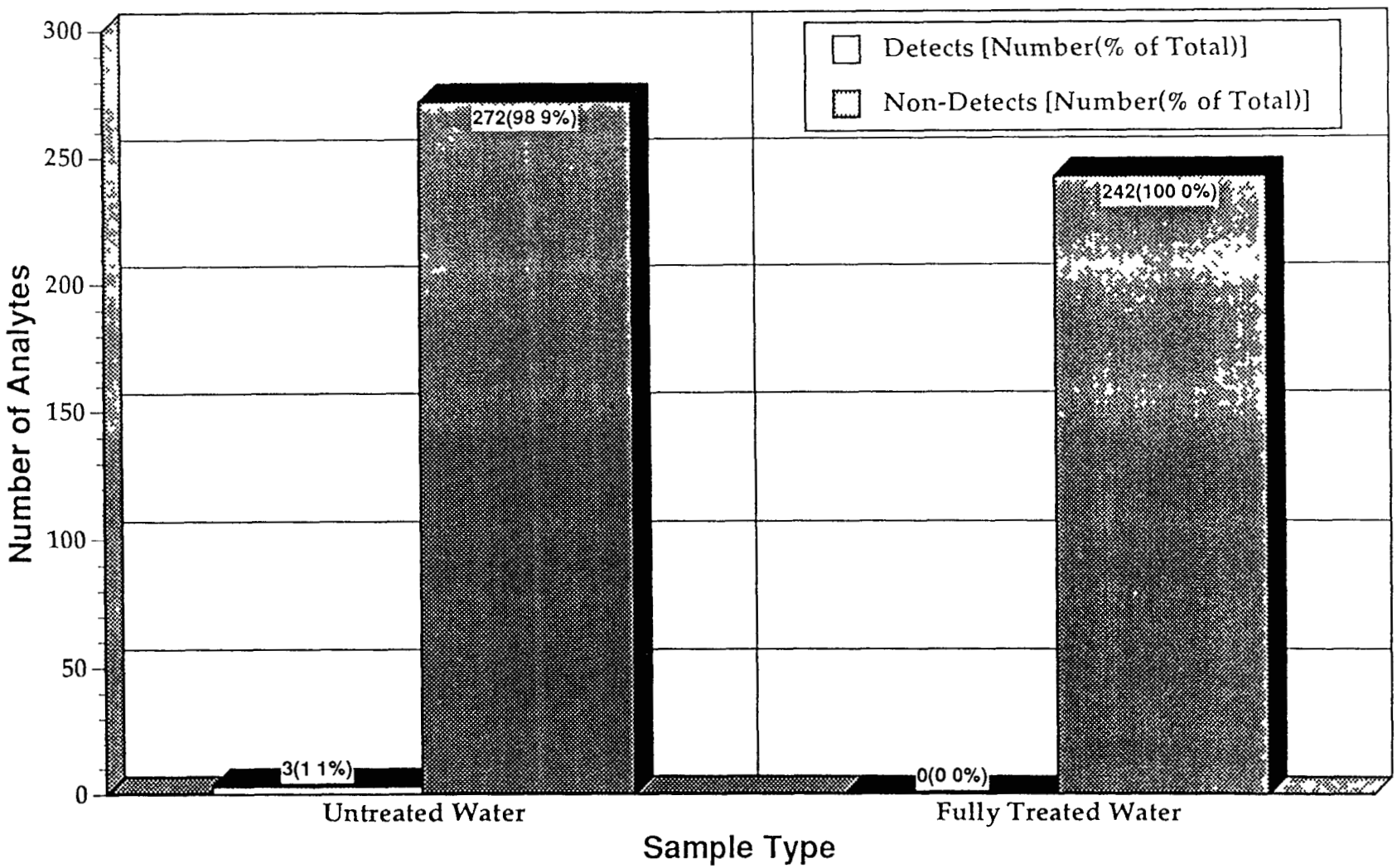


FIGURE 15· POND A-4 WATER QUALITY DATA SUMMARY - Triazine Herbicides (Method 619)

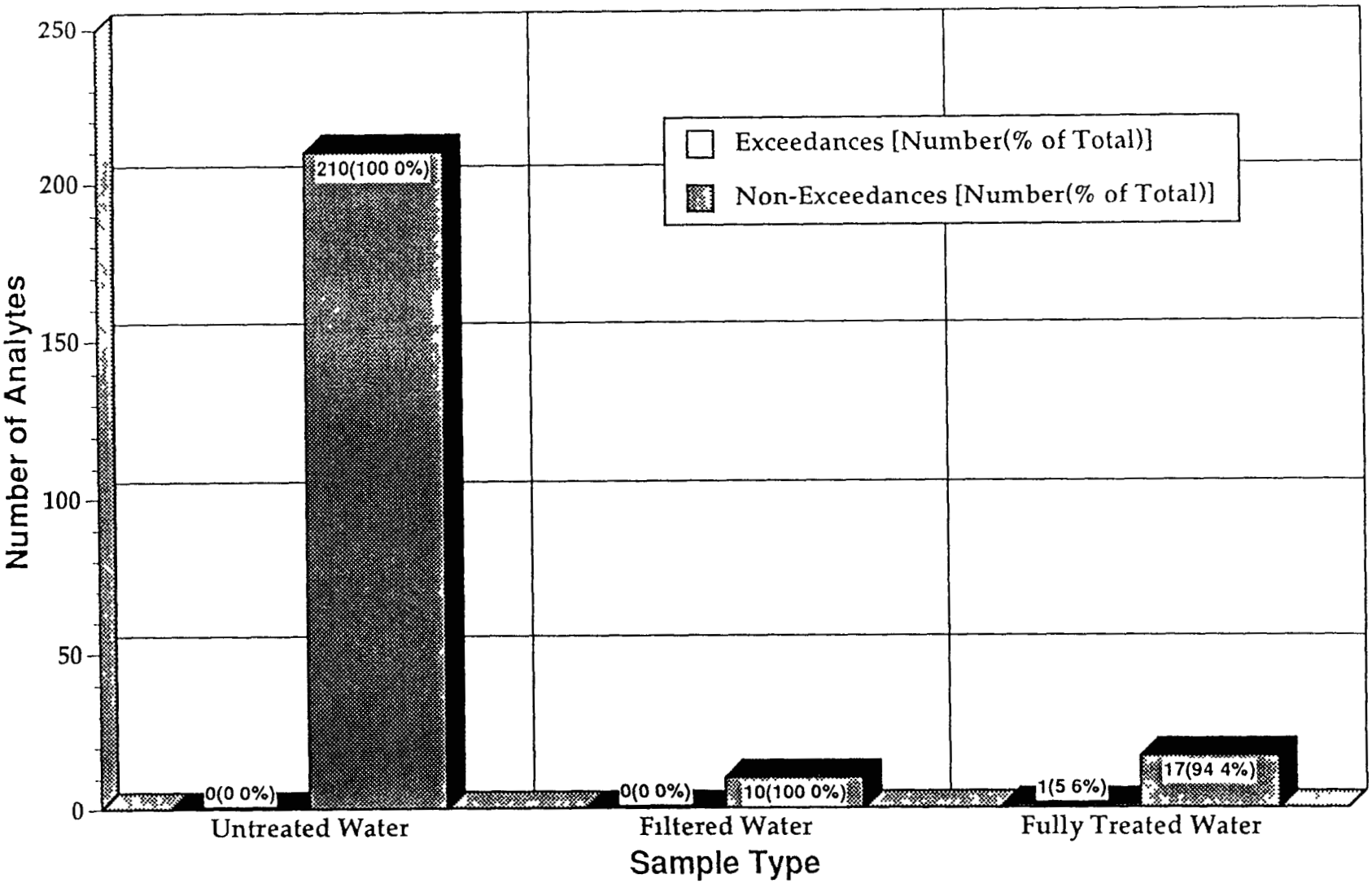


FIGURE 16: POND B-5 WATER QUALITY DATA SUMMARY - Dissolved Radiochemistry

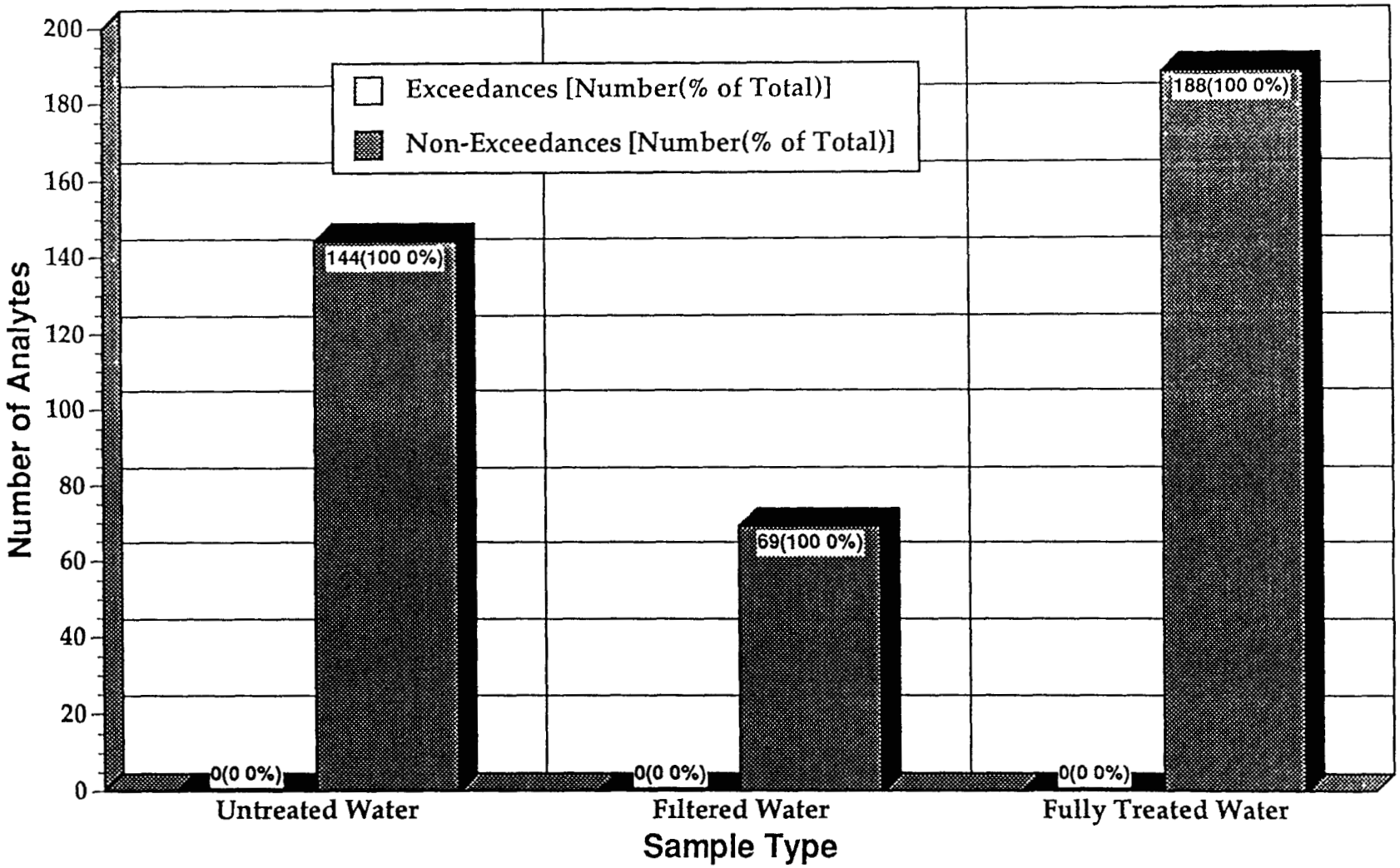


FIGURE 17: POND B-5 WATER QUALITY DATA SUMMARY - Total Radiochemistry

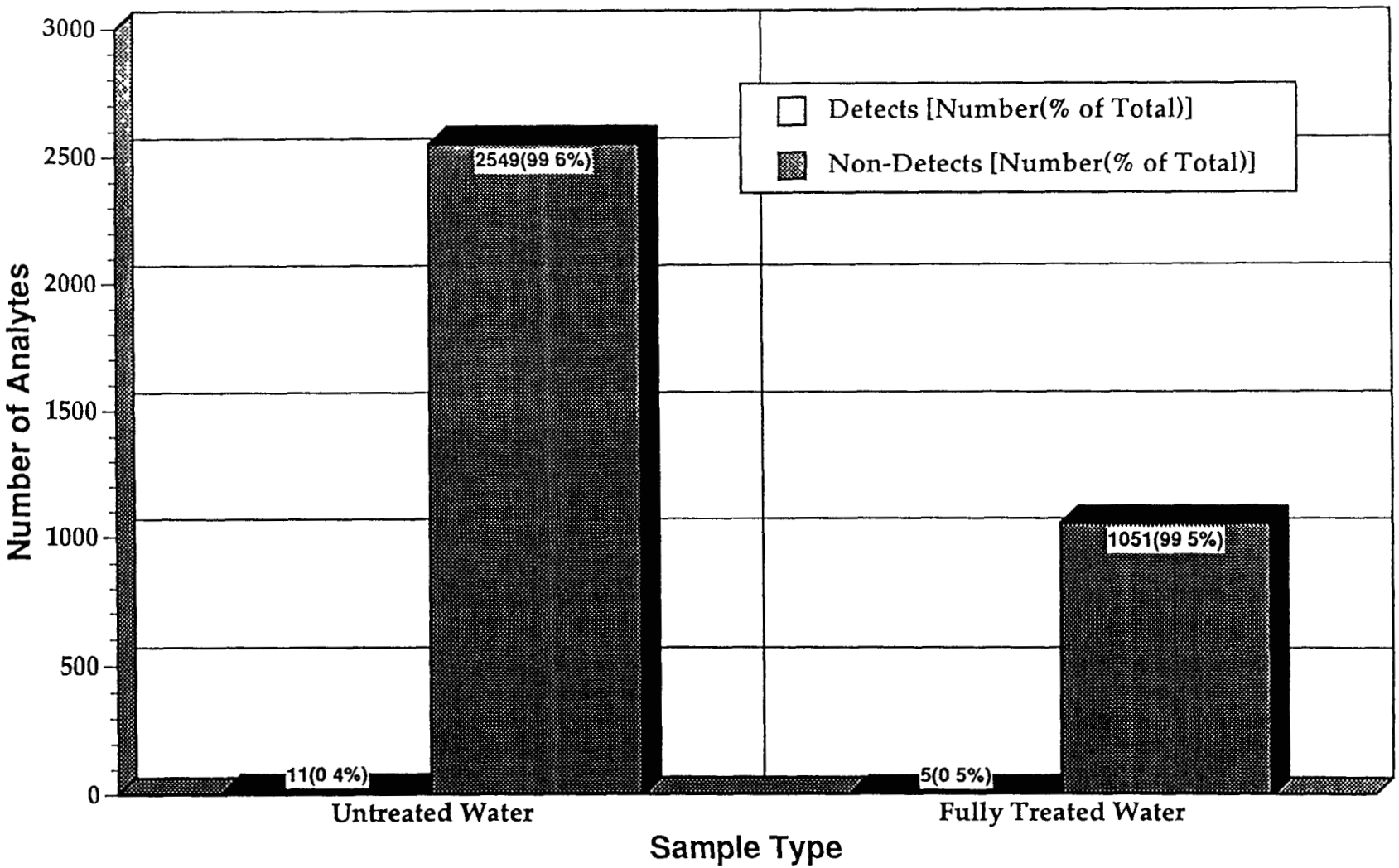


FIGURE 18: POND B-5 WATER QUALITY DATA SUMMARY - Volatile Organics (Method 624)

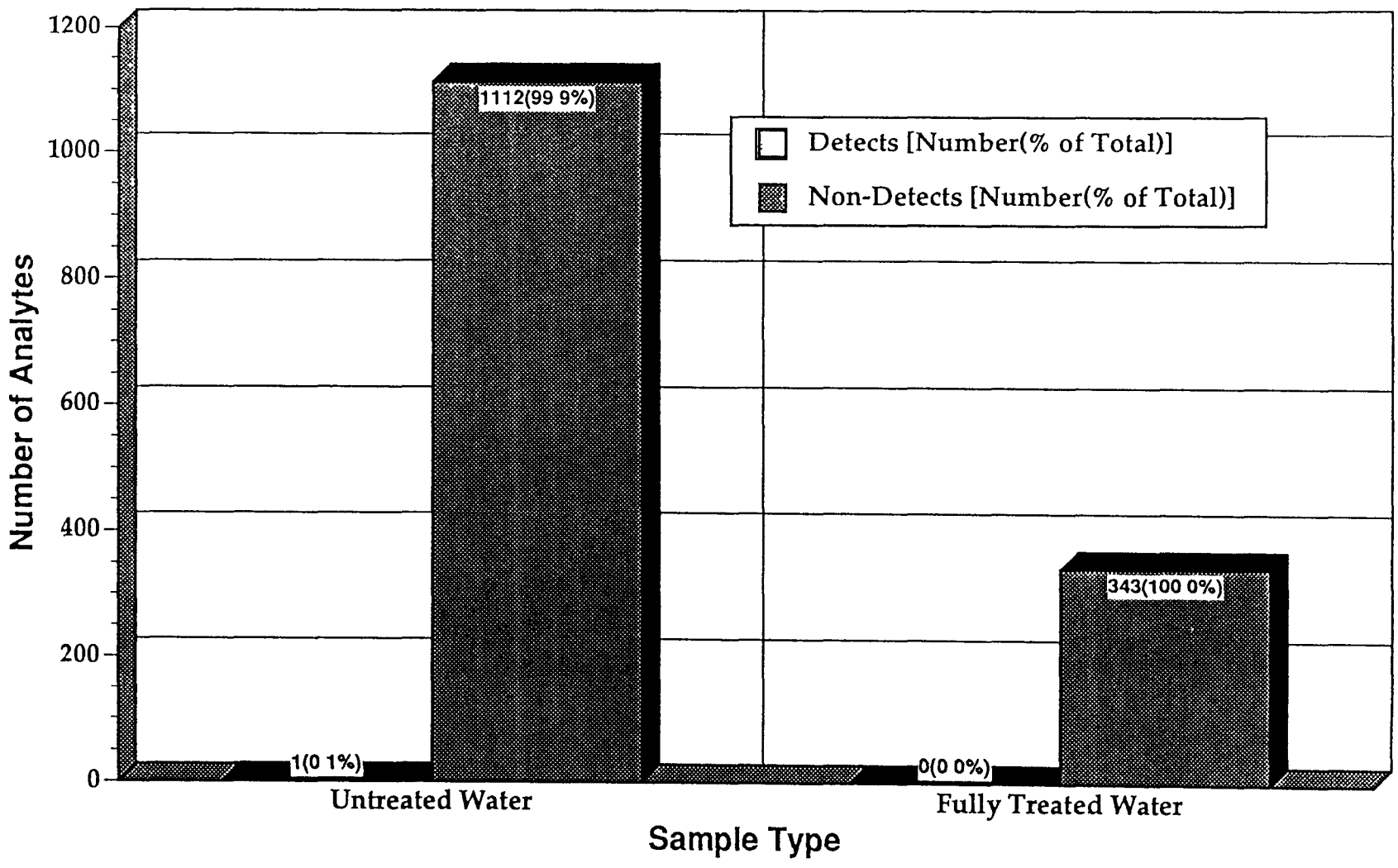


FIGURE 19: POND B-5 WATER QUALITY DATA SUMMARY - Semi-Volatile Organics (Method 625)

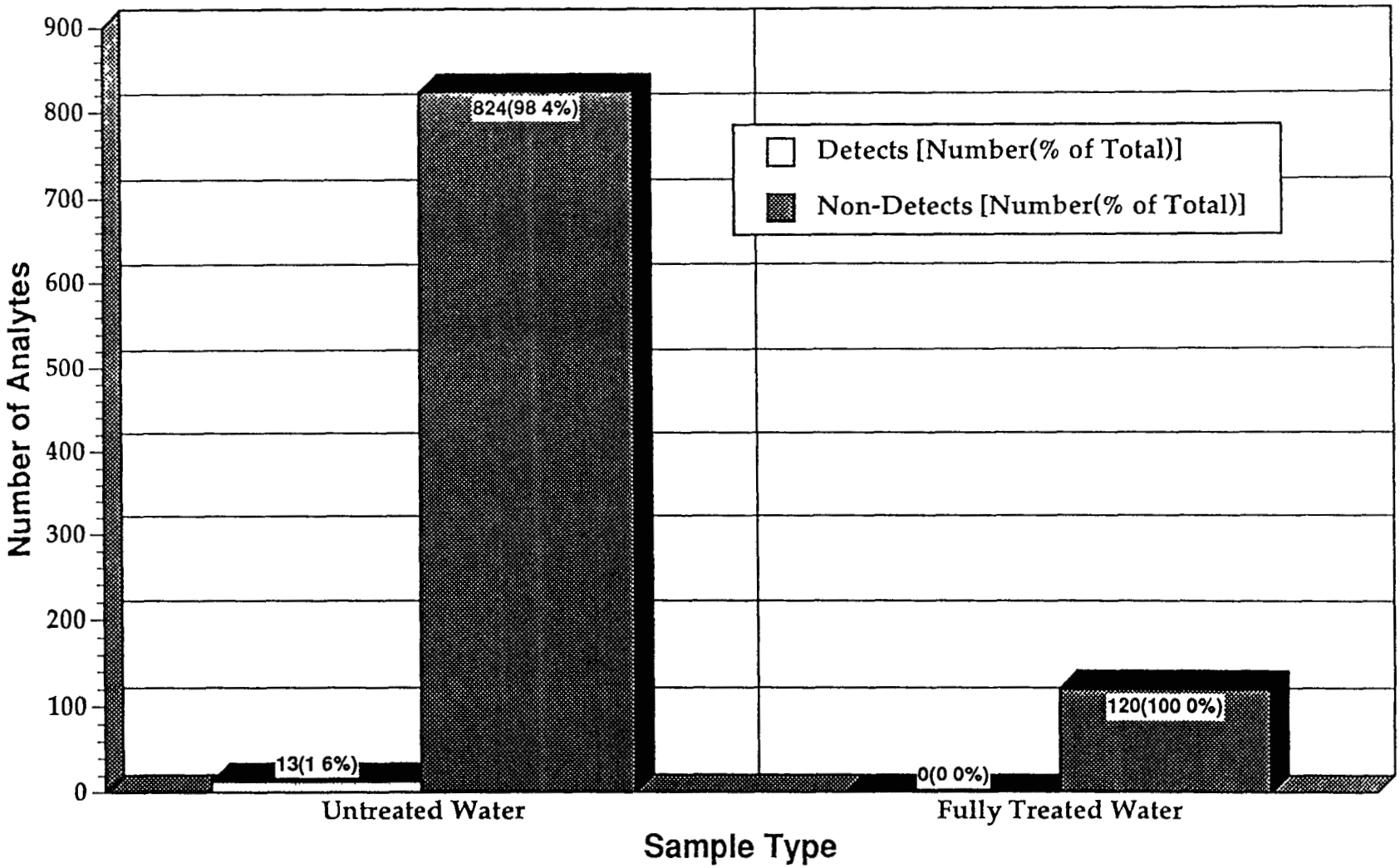


FIGURE 20. POND B-5 WATER QUALITY DATA SUMMARY - Selected Organics (Method 502 2)

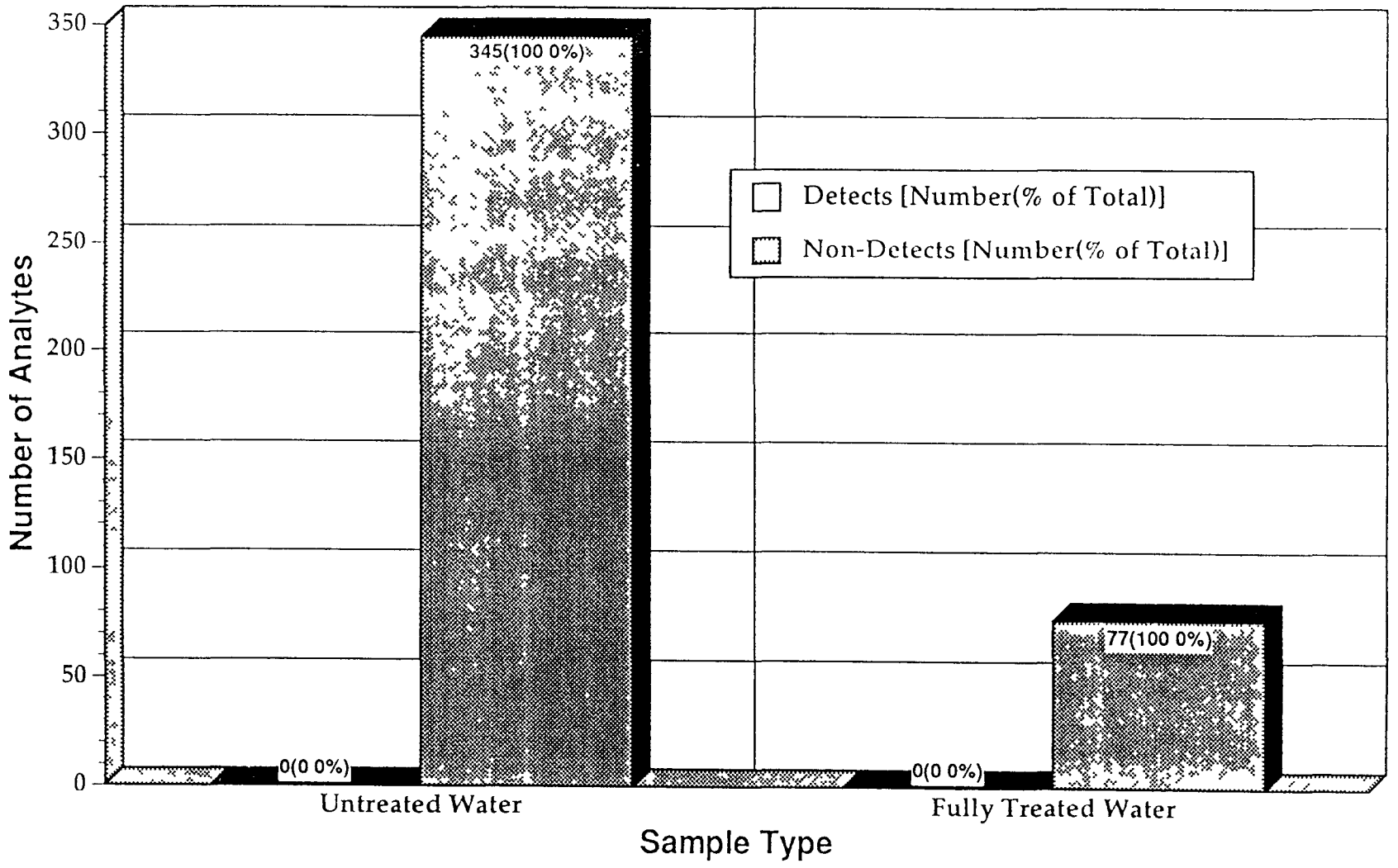


FIGURE 21 POND B-5 WATER QUALITY DATA SUMMARY - Pesticides/PCB's (Method 608)

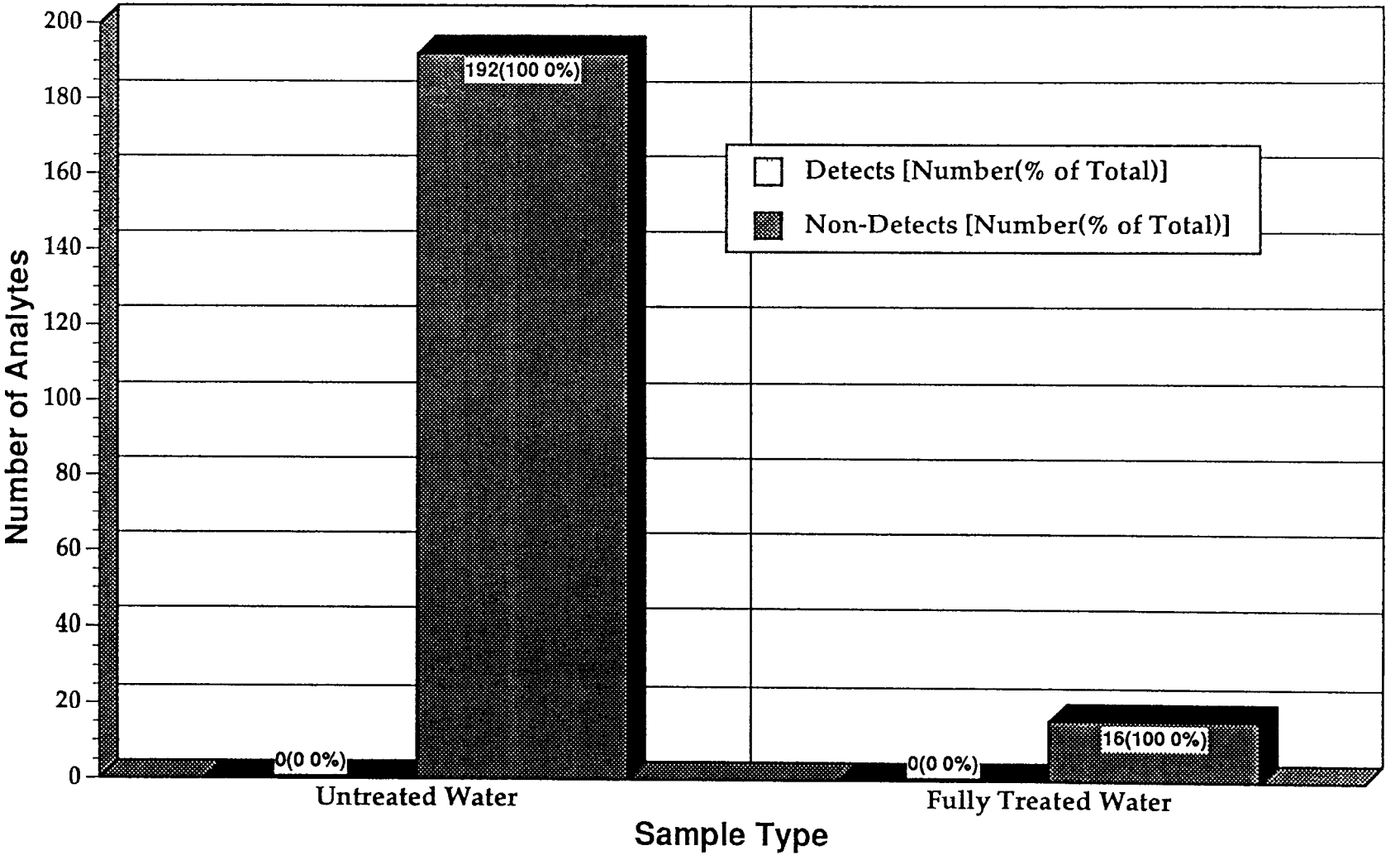


FIGURE 22: POND B-5 WATER QUALITY DATA SUMMARY - PAH Compounds (Method 610)

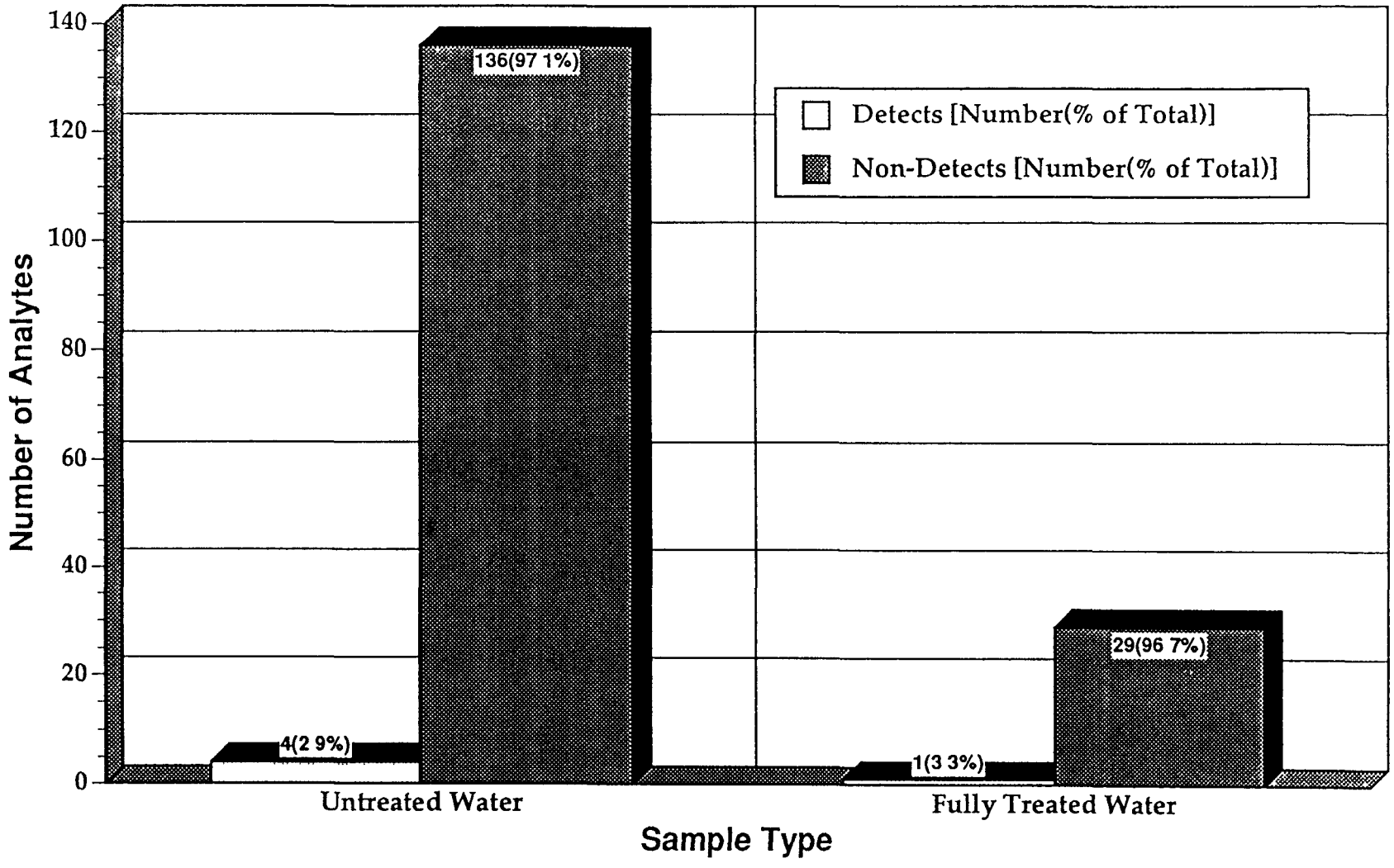


FIGURE 23: POND B-5 WATER QUALITY DATA SUMMARY - Chlorinated Pesticides (Method 615)

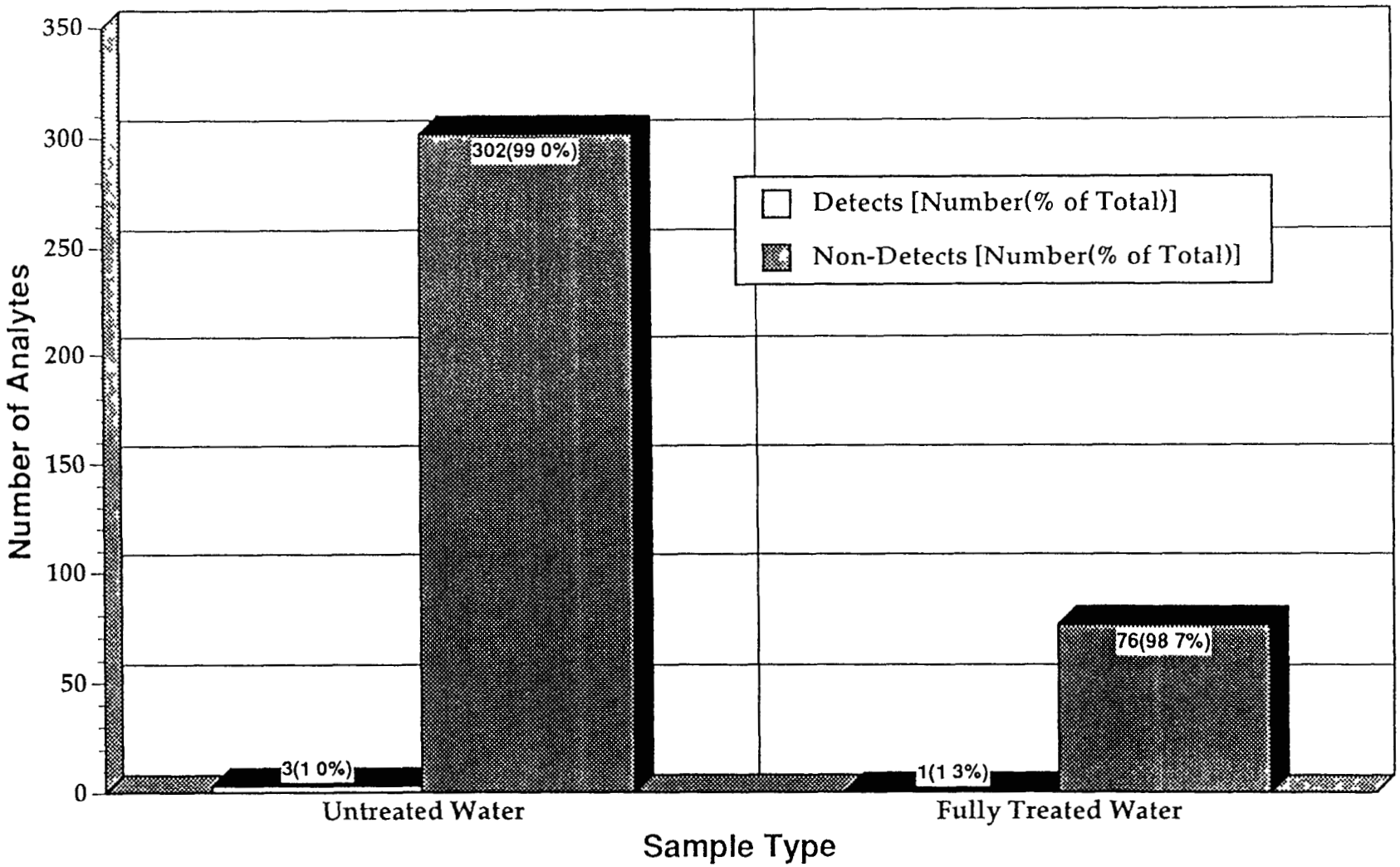


FIGURE 24: POND B-5 WATER QUALITY DATA SUMMARY - Triazine Herbicides (Method 619)

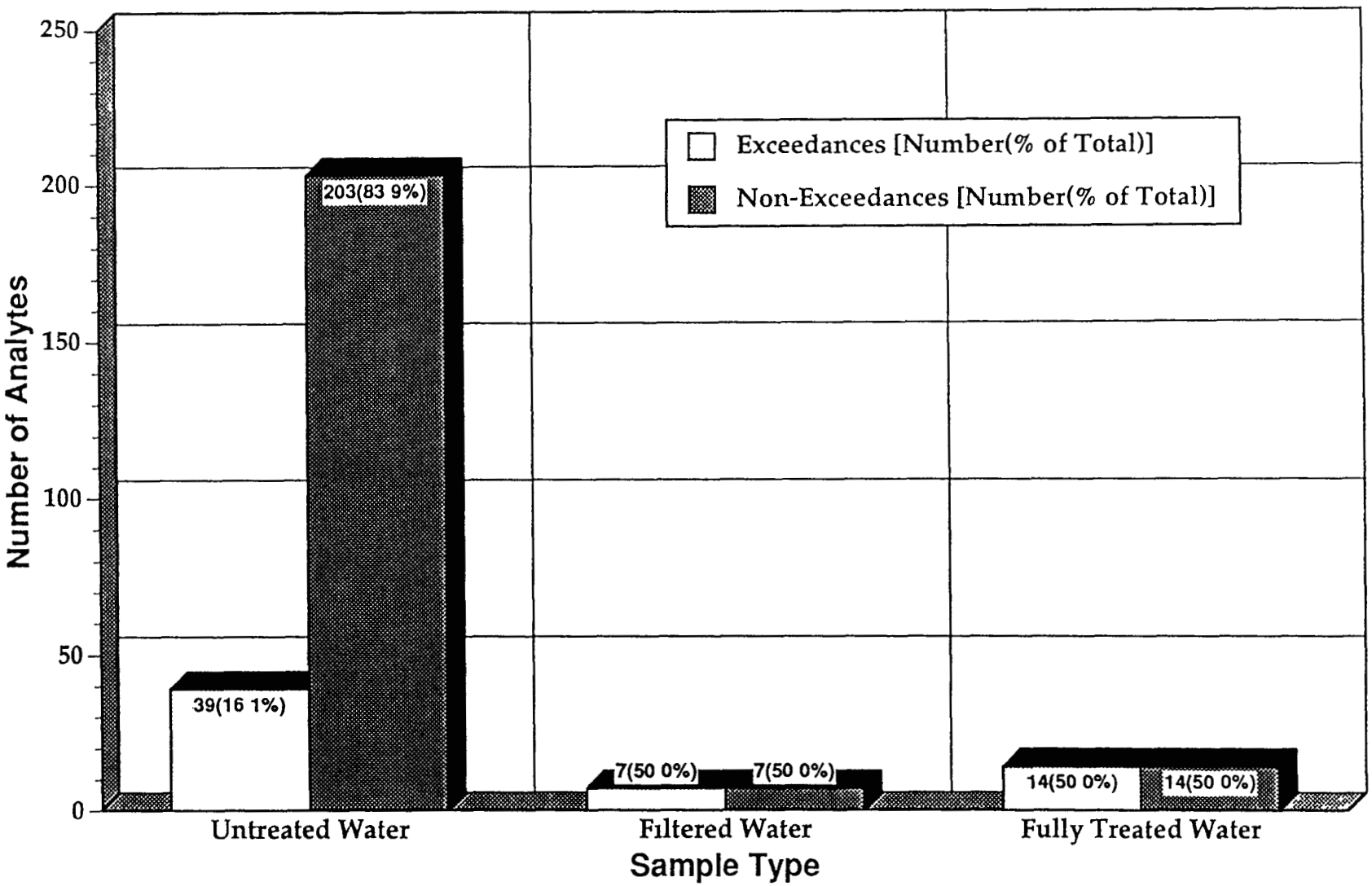


FIGURE 25: POND C-2 WATER QUALITY DATA SUMMARY - Dissolved Radiochemistry

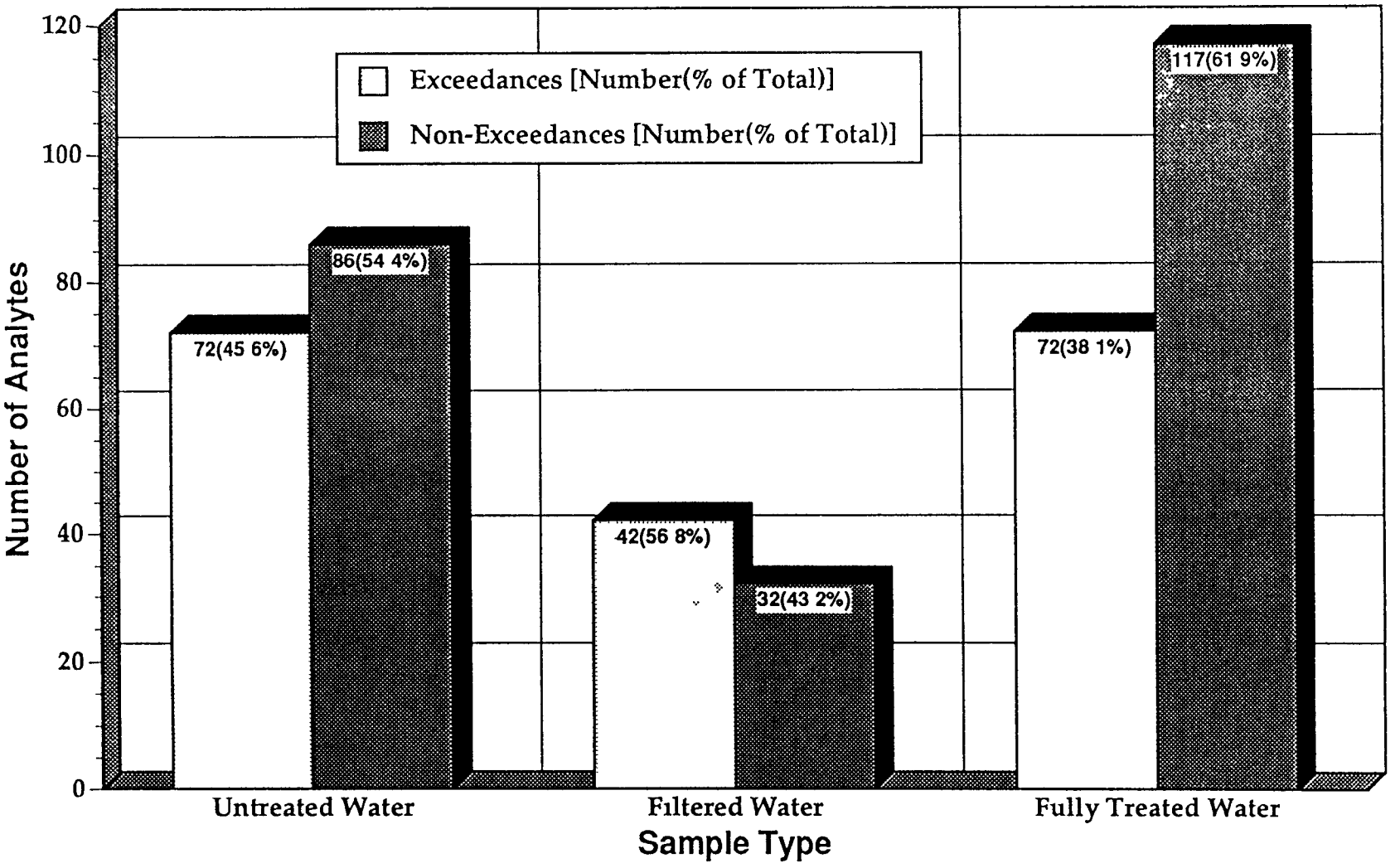


FIGURE 26· POND C-2 WATER QUALITY DATA SUMMARY - Total Radiochemistry

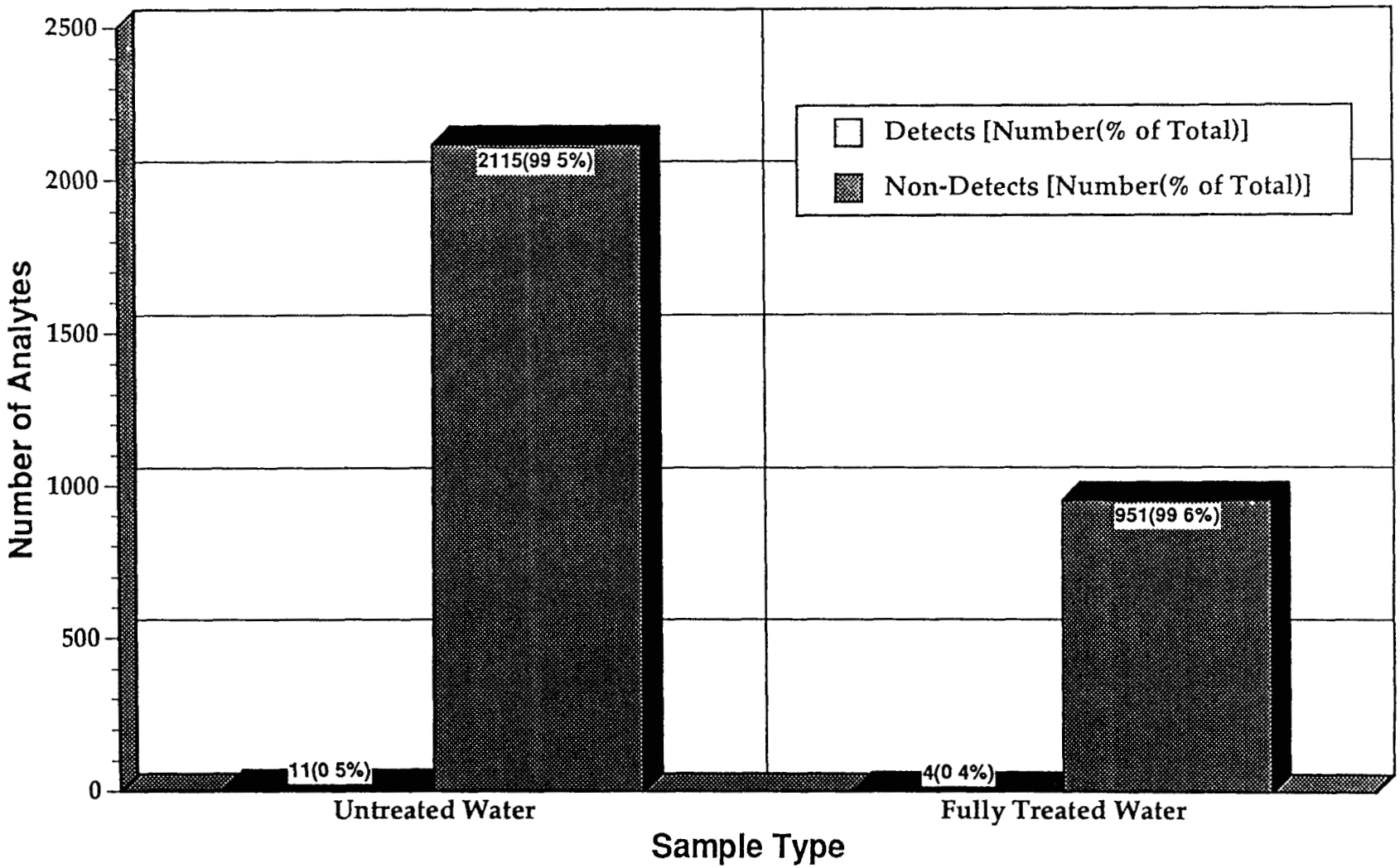


FIGURE 27: POND C-2 WATER QUALITY DATA SUMMARY - Volatile Organics (Method 624)

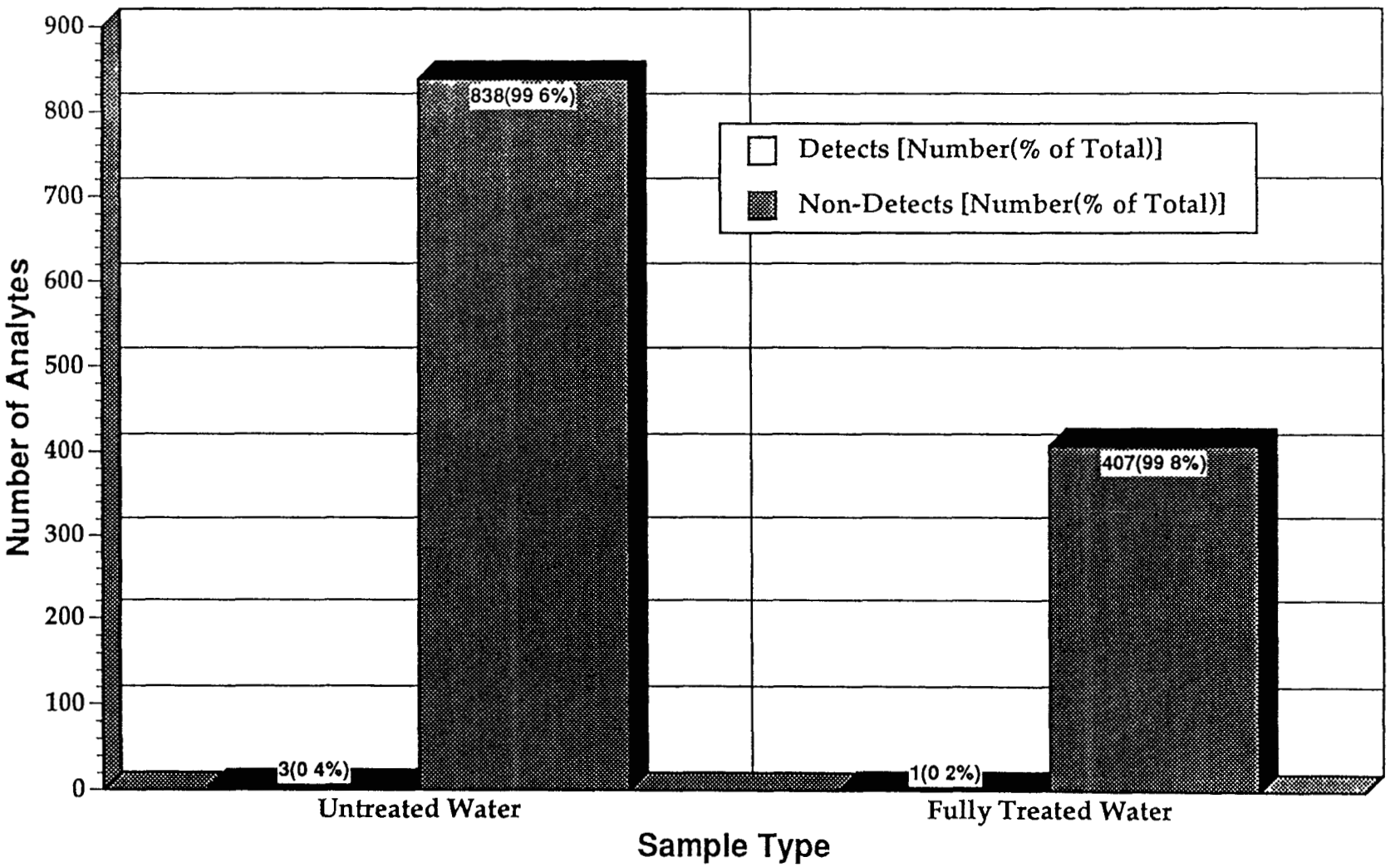


FIGURE 28: POND C-2 WATER QUALITY DATA SUMMARY - Semi-Volatile Organics (Method 625)

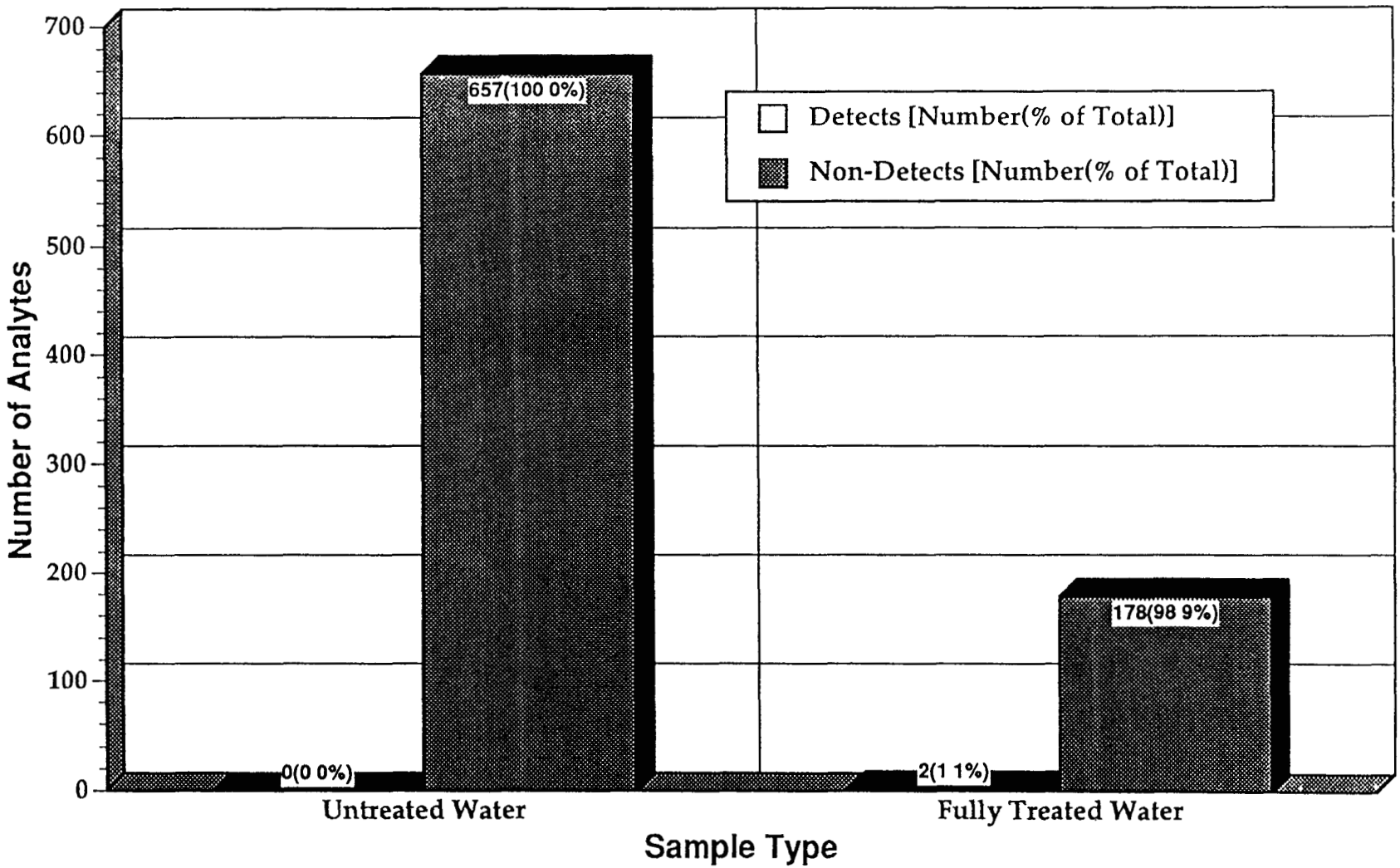


FIGURE 29: POND C-2 WATER QUALITY DATA SUMMARY - Selected Organics (Method 502 2)

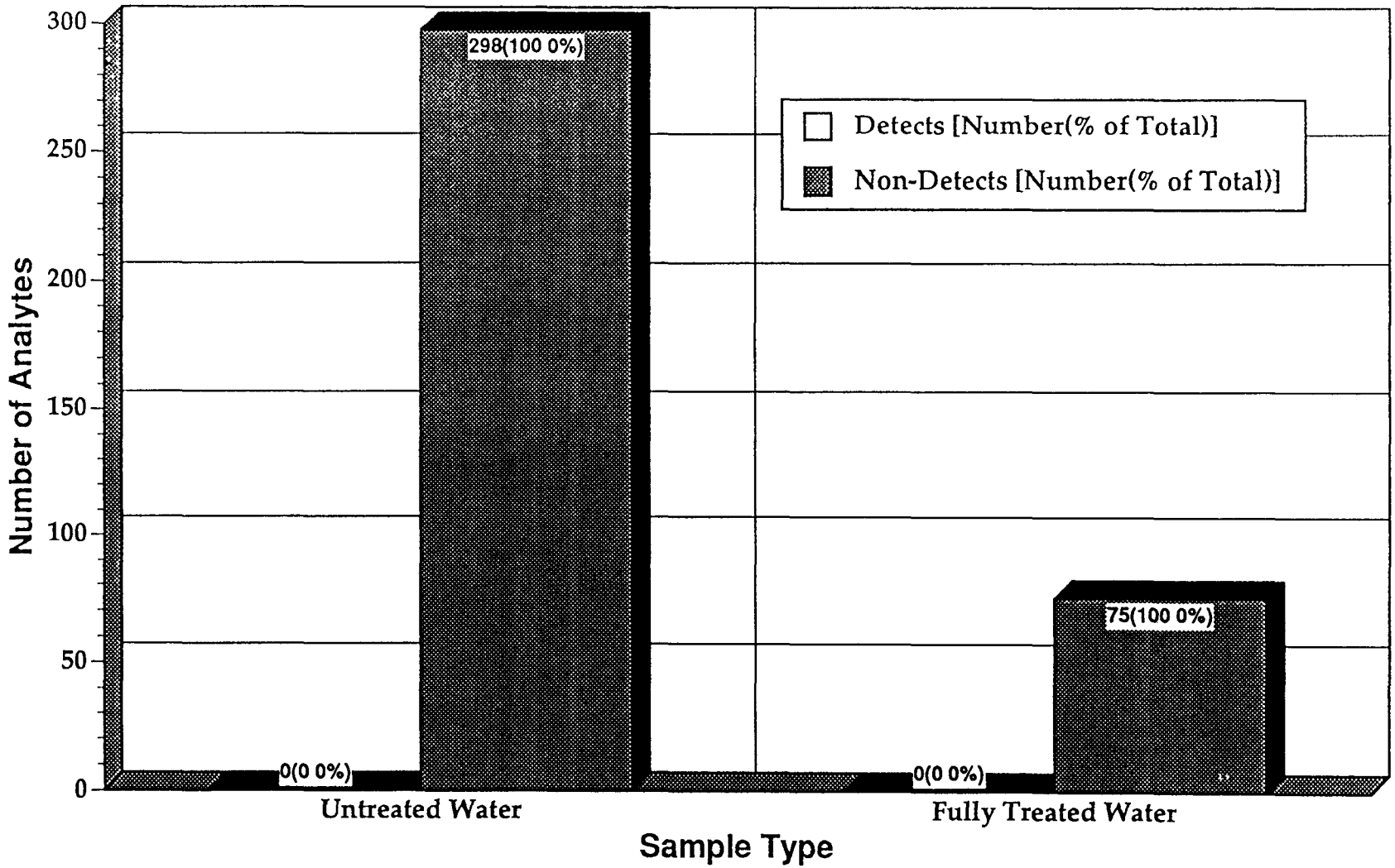


FIGURE 30: POND C-2 WATER QUALITY DATA SUMMARY - Pesticides/PCB's (Method 608)

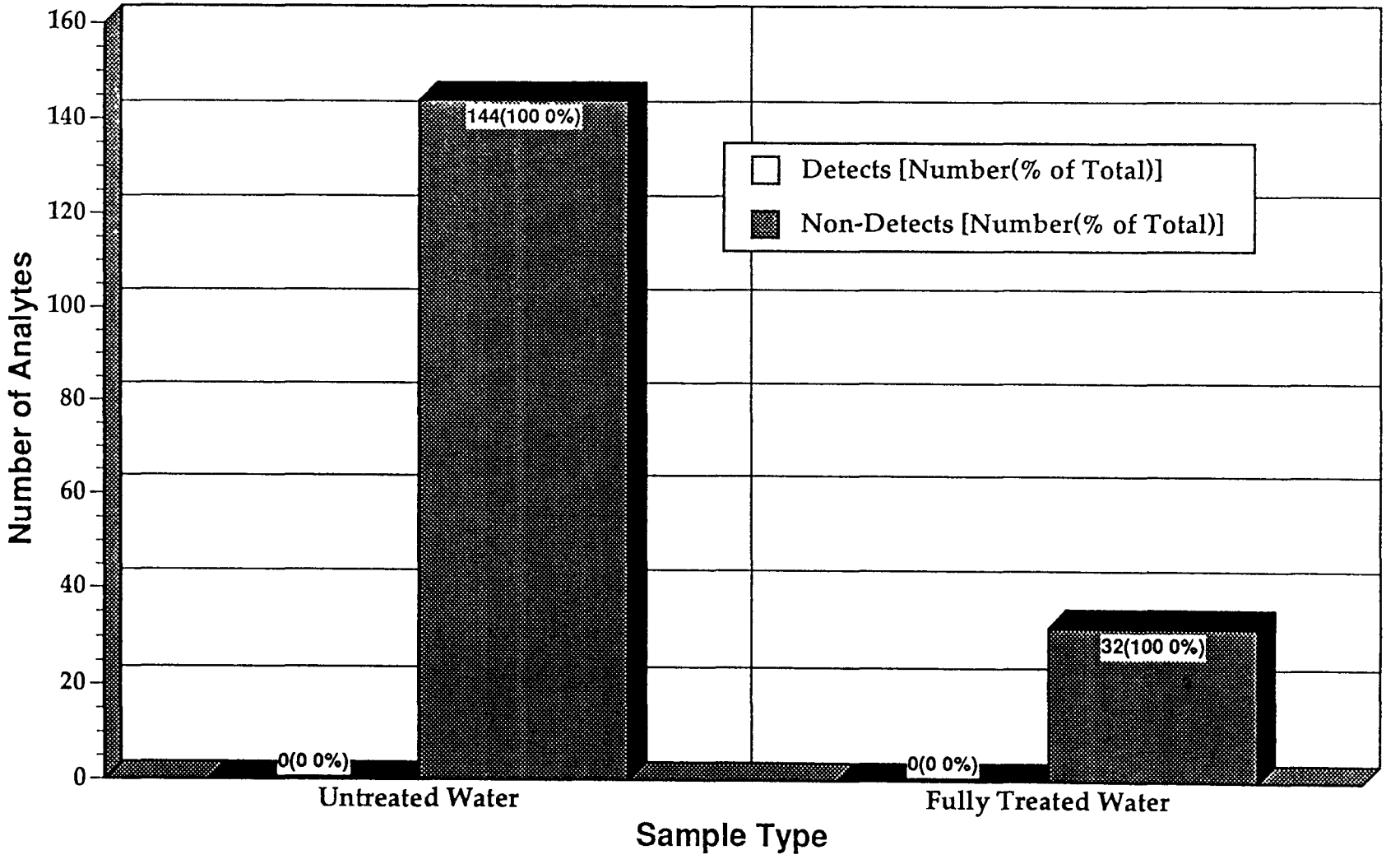


FIGURE 31· POND C-2 WATER QUALITY DATA SUMMARY - PAH Compounds (Method 610)

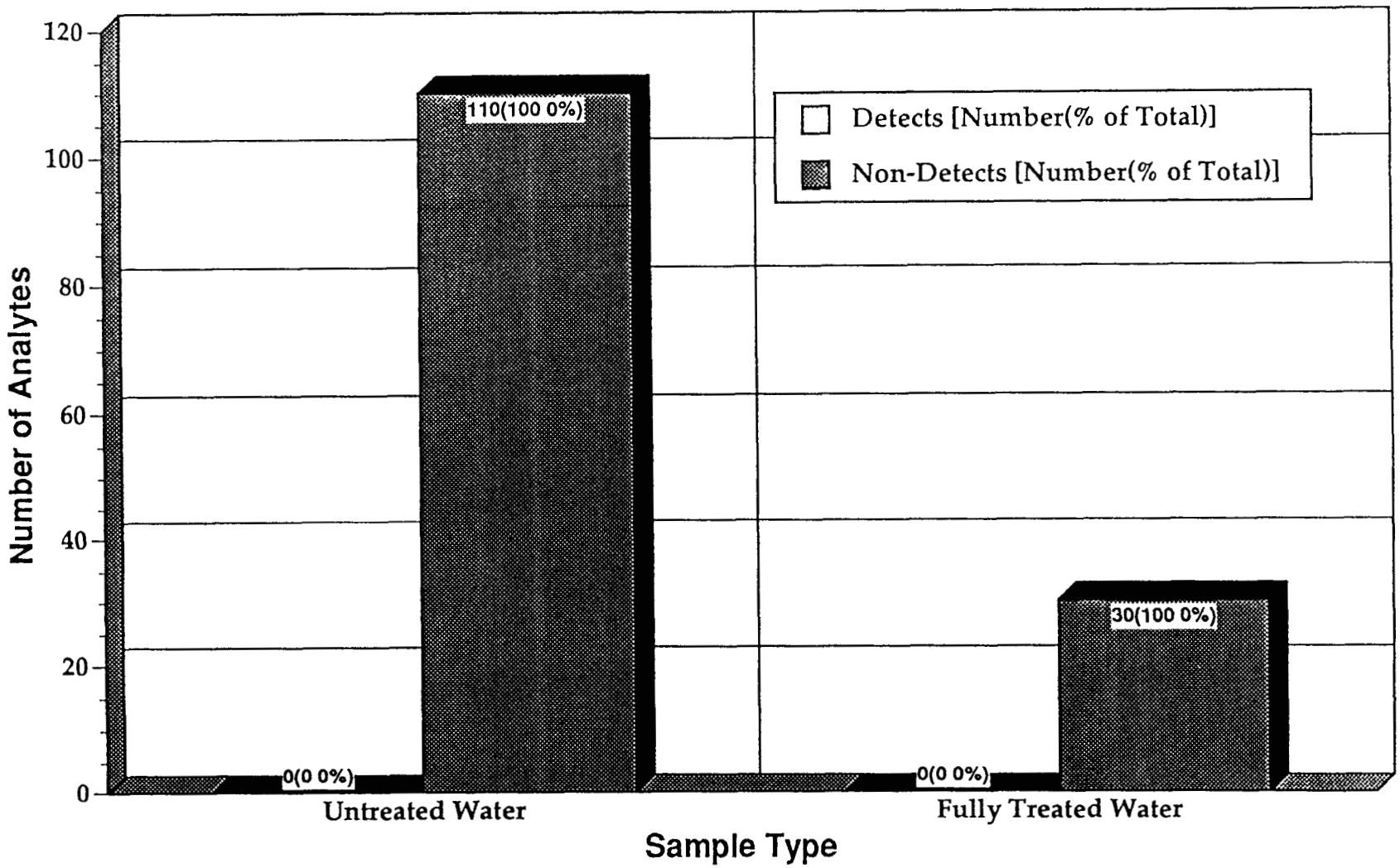


FIGURE 32: POND C-2 WATER QUALITY DATA SUMMARY - Chlorinated Pesticides (Method 615)

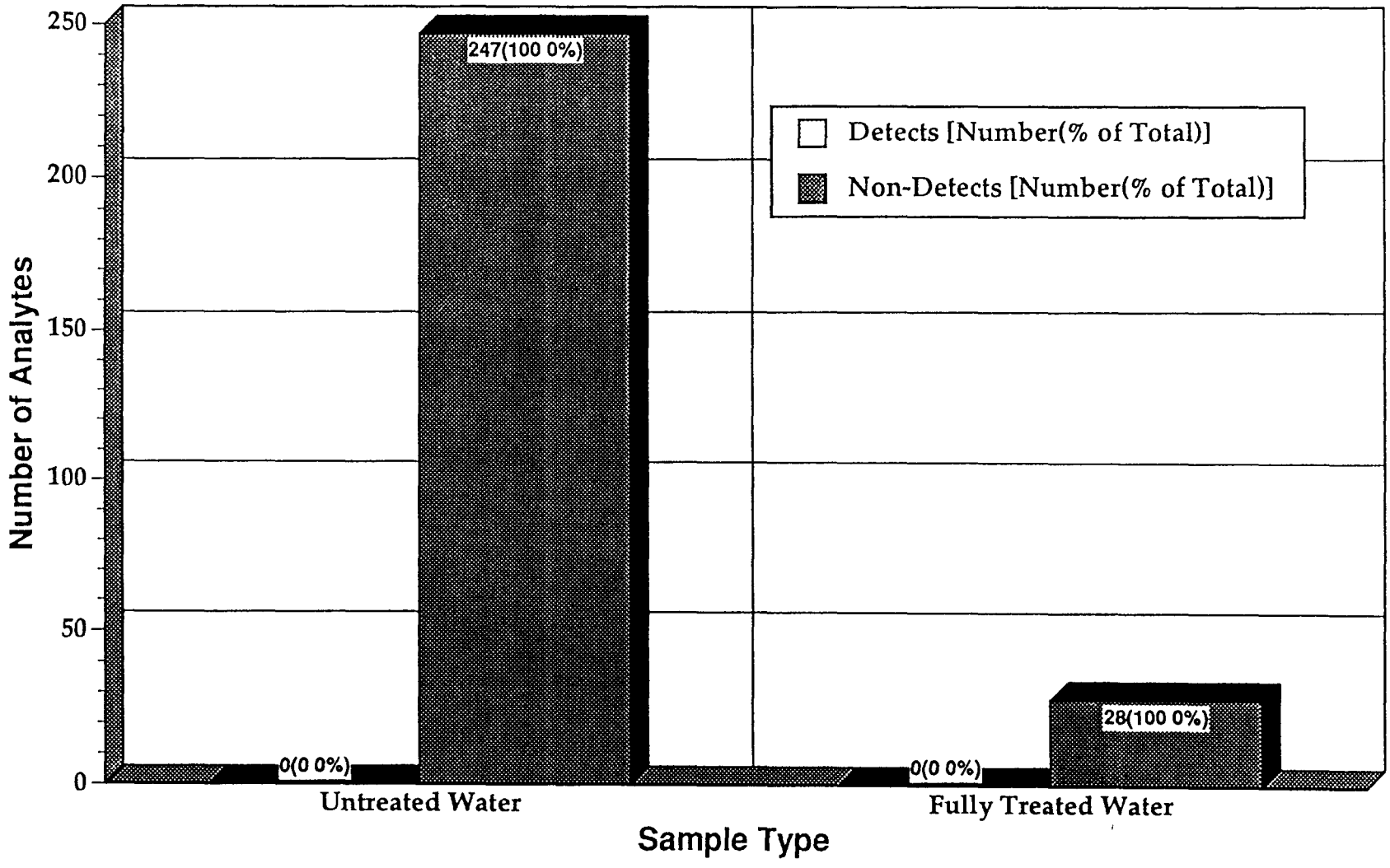


FIGURE 33: POND C-2 WATER QUALITY DATA SUMMARY - Triazine Herbicides (Method 619)